TECHNICAL REPORT
UCED 98/99-04

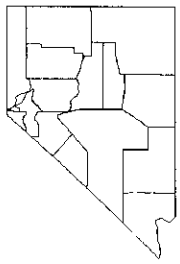
# ECONOMIC IMPACT MODEL

# FOR ANALYSES ASSOCIATED WITH

# THE TRUCKEE RIVER OPERATING AGREEMENT

# AND THE WATER QUALITY SETTLEMENT AGREEMENT

# STUDY AREAS



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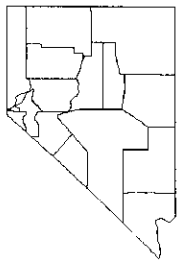

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Study Conducted by:

Tim D. Darden
Thomas R. Harris
Randall Mead
and Karl McArthur

Tim D. Darden is a Research Analyst in the Department of Applied Economics and Statistics at the University of Nevada, Reno.

Thomas R. Harris is a Professor in the Department of Applied Economics and Statistics and Director of the University Center for Economic Development at the University of Nevada, Reno.

Randall Mead is a Research Associate in the Department of Applied Economics and Statistics at the University of Nevada, Reno.

Karl McArthur is a Research Associate in the Department of Applied Economics and Statistics at the University of Nevada, Reno.



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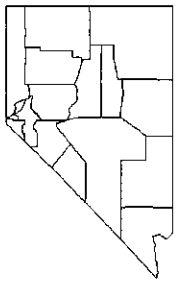
Thomas R. Harris, Director
University Center for Economic Development
University of Nevada, Reno
Department of Applied Economics and Statistics
Mail Stop 204
Reno, Nevada 89557-0105



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The overall objective of this paper is to develop an economic impact model for estimating the economic effects from alternatives considered in the Truckee River Operating Agreement (TROA) Environmental Impact Statement (EIS) and the Water Quality Settlement Agreement (WQSA) EIS study area from exogenous changes, such as changes in surface water allocations, reallocation of surface waters, etc. A social accounting model of the TROA/WQSA study area was developed to estimate the economic interrelationships, more commonly called linkages, between economic sectors in the study area. These linkages are used to estimate impacts on economic sectors and distributional impacts by income levels in the TROA/WQSA study area from given changes in the TROA/WQSA study area economy. Specific objectives are:

1. Review the basic concept of community economics;
2. Discuss the TROA/WQSA study area;
3. Discuss control total data;
4. Discuss social accounting modeling;
5. Develop and discuss a social accounting impact model of the TROA/WQSA study model.
6. Develop and discuss a Leontief Input-Output Model of the TROA/WQSA study area.

## BASIC CONCEPT OF COMMUNITY ECONOMICS

Community economics is an applied field of economics that investigates the interrelationships, more commonly called linkages, that exist among economic sectors within a local economy. An overview of a community economic system is presented in Figure 1. Economic sectors shown are basic industries, households and service firms. The linkages that exist among these sectors are depicted by Figure 1.

Basic industries are those industries that produce goods and services primarily for sale outside the economy. These industries are usually involved in agriculture, mining, manufacturing, casino gaming or federal government activities, such as the Test Site. Household and service firms support basic industries. Labor is purchased from households and inputs are purchased from service firms. Service firms also provide goods and services to households (consumers). Of course, each of these three sectors purchase products, inputs and labor from outside the community borders. Local transactions determine the relationship that exists among the various types of firms in an economy. These three sectors are also linked with the rest of the economy through inflow and outflow of income, inputs and labor, goods and services and finished products.

The total impact of any basic industry on an economy consists of direct, indirect and induced impacts. Direct impacts are the activities or changes in production level of the impacted industry. Indirect impacts occur in the local business sector as a result of providing inputs to the impacted industry. For example, the increased output of local firms providing inputs for a local mining operation represent the indirect impacts of a basic industry. Induced impacts consist of the economic activity caused by household consumption in a local economy from the direct and indirect effects.

The relationships discussed above indicate how basic industries serve as the foundation of an economy and how households and service firms are necessary to make the economy function. Service industries account for a substantial part of the output of most economies, but, as shown in Figure 1, much of service industry output goes to support local basic industries and households. Mathematical techniques, such as input-output analysis, can be used to measure the relationships between basic industries, households and service firms.

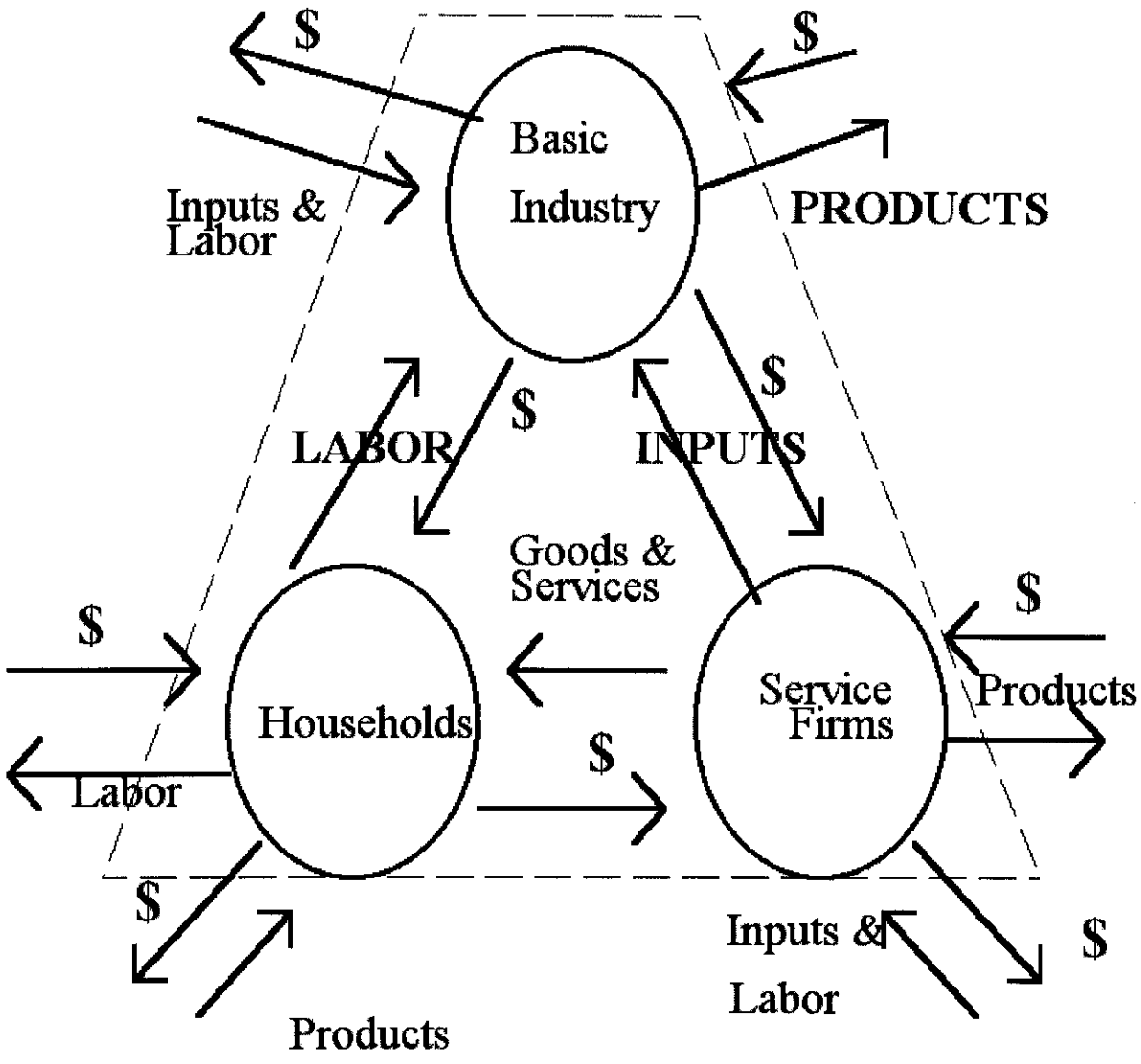



**Figure 1. Overview of Community Economic System**

## TROA/WQSA STUDY AREA

The TROA/WQSA study area for this paper covers three counties in Nevada (Churchill, Lyon and Washoe Counties) and parts of five California counties (Sierra, Nevada, Placer, El Dorado and Alpine). The original TROA-EIS study area, as defined in the UNR Technical Report UCED 94-18 (19), was expanded to include Churchill County and Lyon County, so as to examine the economic impacts from alternatives identified in both the TROA and WQSA EIS documents and generally, as they relate to the local and regional economy. The TROA/WQSA model will also delineate the agricultural sectors of the Fernley area and the Swingle Bench/Hazen portion of Churchill County for the analysis.

The Truckee Meadows includes the communities of Reno and Sparks and has a diversified economy including, gaming, warehousing and some light manufacturing industries. Although the Truckee Meadows relies significantly on the Truckee River for its municipal and industrial water, there is an increasing recognition of the importance of having a clean and scenic river to enhance the quality of life in the Truckee Meadows. The Washoe County Regional Planning Board initiated a Truckee River Corridor effort to protect and enhance the river. Also, the Reno Redevelopment Commission has initiated a number of downtown projects associated with the river to encourage both local residents and tourists to visit local parks and walkways along the river.

In addition to local efforts involved with improving water quality in the Truckee River, an agreement between the United States, the Pyramid Lake Paiute Tribe, Washoe County, the cities of Reno and Sparks, and the State of Nevada, called Water Quality Settlement Agreement was signed in October 1996. In short, this agreement provides for the joint acquisition of water rights along the Truckee River corridor, including the irrigated lands along the Truckee Canal that in turn will be dedicated to improving water quality in the river by enhancing flows.

The Truckee River provides irrigation water to the Truckee Meadows. The irrigated acreage is meadows, pastures or alfalfa fields. Cattle graze on the meadows and pastures and are fed hay from the alfalfa fields. The irrigation water is diverted from the river, creeks and drainage water into ditches. These irrigation water rights are dictated in the Orr Ditch Decree.

Over time, the irrigation water rights are being purchased for municipal and industrial

(M & I) purpose as the region's population expands. Truckee Meadows population is expected to grow by 2.0 to 2.5 percent annually. As a result, commercial, industrial and residential water demands will increase. As transfers of water from agriculture to M & I users continue, income and employment in the agricultural sector can be expected to diminish with consistent increases in other sectors purchasing water from agriculture.

East of the Truckee Meadows and near the town of Wadsworth, part of the Truckee River water is diverted at Derby Dam into the Truckee Canal. The diverted water continues east through the Truckee Canal for irrigation in the Newlands Reclamation Project operated by the Truckee-Carson Irrigation District (TCID). The Newlands Project consists of two divisions, the Truckee Division and the Carson Division. The Truckee Division encompasses the town of Fernley and the Hazen/Swingle Bench area along the Truckee Canal. The Carson Division surrounds the town of Fallon. Within the Newlands Project approximately 60,000 acres are irrigated with water from both the Truckee and Carson Rivers. Irrigation water from both rivers is stored in the Lahontan Reservoir and released on demand to farms in the Carson Division, including farms on the Fallon Indian Reservation. Outflows of water from the Carson Division and Fallon Indian Reservation go to the wetlands in the Lahontan Valley, including Stillwater National Wildlife Refuge and Carson Lake Pasture, which is managed by the State of Nevada. Both areas are managed as wetlands providing habitat for fish, wildlife and migratory fowl.

Recreation activities along the lower Carson River are primarily associated with fishing and other recreational uses on Lahontan Reservoir and hunting and bird watching associated with the Lahontan Valley wetland complex. The TROA/WQSA model will be developed to estimate impacts of reallocation of surface waters on the study area economy.

## CONTROL TOTAL DATA

To build an input/output model or social accounting matrix the first step is to develop and accumulate control totals for each economic sector to be included in the model or used to develop impact coefficients. These types of data include, employment, value of output, and value added. Also included with the TROA/WQSA analysis is population estimates, number of housing units, agricultural water use, commercial water use and residential water use (metered and non-metered). The latter figures will be used to develop coefficients based on output values

for population changes, water use changes and changes in occupied dwellings. Included with the updated TROA/WQSA study area model are two additional models explained in UNR Technical Report UCED 94-18 (19). The methodology was the same as the original Truckee River Basin impact model except new data was included to represent the social accounts and additional economic sectors included with the new model.

The following tables deal with the derivation of coefficients used to determine demographic changes in the study area given a change in economic activity or a given change in water use. This section will show model and state totals for California and Nevada. For detailed information by county please see appendix B.

**Employment**

The first group of control total data collected for this model was the employment data. The employment was used for the basis of all other control total data with exception of agricultural output. The employment figures were taken from the U. S. Department of Commerce's Bureau of Economic Analysis Regional Economic Information System (REIS) (34) for 1995. These employment figures are given as total jobs full or part-time by one digit standard industrial classification. These employment totals were then broken down into smaller economic sectors matching the TROA/WQSA model by using the corresponding 1995 IMPLAN data set sectoral distribution. California numbers were derived by taking the percentage of population, from the 1990 Census of Population (30), within the TROA/WQSA study area and multiplied by the IMPLAN employment for that county. Table 1 shows the employment, by sector, for California and Nevada for 1995.

**Table 1. Employment by Economic Sector for the TROA/WQSA Study Area by State**

| Economic Sector | California Jobs | Nevada Jobs | Total Jobs |
|---|---|---|---|
| 1 Dairy Production | 3 | 164 | 167 |
| 2 Livestock Production | 8 | 410 | 418 |
| 3 Other Production Agriculture | 40 | 148 | 188 |
| 4 Other Hay | 0 | 28 | 28 |
| 5 Feed Grains | 0 | 11 | 11 |
| 6 Rest of Alfalfa | 1 | 623 | 624 |
| 7 Swingle Bench/Hazen/Fernley Alfalfa | 0 | 37 | 37 |
| 8 Agricultural Services | 185 | 2,099 | 2,284 |
| 9 Gold Mining | 15 | 742 | 757 |
| 10 Other Mining | 38 | 564 | 602 |
| 11 Construction | 2,129 | 15,016 | 17,145 |
| 12 Manufacturing | 1,298 | 15,403 | 16,701 |
| 13 Transportation and Communications | 484 | 11,247 | 11,731 |
| 14 Utilities | 121 | 1,625 | 1,746 |
| 15 Trade | 3,202 | 36,781 | 39,983 |
| 16 Eating, Drinking | 1,459 | 10,450 | 11,909 |
| 17 Finance, Insurance, and Real Estate | 1,608 | 14,510 | 16,118 |
| 18 Hotels, Gaming, and Recreation | 1,339 | 38,327 | 39,666 |
| 19 Services | 3,336 | 37,845 | 41,181 |
| 20 Health | 1,645 | 13,732 | 15,377 |
| **Total** | 16,911 | 199,762 | 216,673 |

## Value of Output

The value of output from a given sector is simply the gross sales of an industry or when discussing production agriculture the output is defined as the gross value of production of the crop in question. For all non-agricultural sectors the ratio of 1995 IMPLAN data set employment to output was multiplied by the adjusted employment figure derived above. For agricultural production sectors a five-year average value of production was derived using Nevada Agricultural Statistics data and coupled with the employment and ratio's derived using the IMPLAN PRO software (20) and 1995 IMPLAN data set. In deriving the California totals zip code data from the 1992 census of agriculture was used to determine if any agricultural production took place in the study area. Nevada County California zip codes were found to have the only California agricultural production in the study area. Table 2 shows the value of output by state and sector used in the TROA/WQSA model.

## Income

The income component includes employee compensation and proprietor income. The same procedures were followed when collecting the income data in using the ratio of employment to each of the components included in income. REIS wage and salary data along with proprietor's income data was used and checked against derived numbers from IMPLAN. All income numbers were adjusted to place of residence and place of work income using REIS journey to work data for each county. Table 3 shows the total income for the TROA/WQSA study area by state.

**Table 2. Output by Economic Sector for the TROA/WQSA Study Area by State**

| Economic Sector | California $ | Nevada $ | Total $ |
|---|---|---|---|
| 1 Dairy Production | 1,019,567 | 25,417,073 | 26,436,640 |
| 3 Livestock Production | 1,798,675 | 29,370,001 | 31,168,676 |
| 10 Other Production Agriculture | 4,319,906 | 27,263,814 | 31,583,720 |
| 11 Other Hay | 0 | 2,531,060 | 2,531,060 |
| 12 Feed Grains | 0 | 636,010 | 636,010 |
| 13 Rest of Alfalfa | 133,638 | 32,063,360 | 32,196,998 |
| 14 Swingle Bench/ Hazen/Fernley Alfalfa | 0 | 2,025,040 | 2,025,040 |
| 6 Agricultural Services | 4,924,761 | 43,844,083 | 48,768,844 |
| 7 Gold Mining | 3,164,631 | 203,151,365 | 206,315,997 |
| 8 Other Mining | 5,242,390 | 71,145,361 | 76,387,751 |
| 9 Construction | 185,056,937 | 1,565,610,158 | 1,750,667,095 |
| 10 Manufacturing | 178,091,176 | 2,401,946,811 | 2,580,037,987 |
| 11 Transportation and Communications | 62,421,078 | 1,225,946,211 | 1,288,367,289 |
| 12 Utilities | 44,287,827 | 612,402,336 | 656,690,163 |
| 13 Trade | 164,583,896 | 2,175,550,354 | 2,340,134,250 |
| 14 Eating, Drinking | 50,858,266 | 369,981,016 | 420,839,282 |
| 15 Finance, Insurance, and Real Estate | 319,368,644 | 2,702,542,189 | 3,021,910,833 |
| 16 Hotels, Gaming, and Recreation | 60,410,387 | 2,300,904,979 | 2,361,315,366 |
| 17 Services | 150,755,285 | 2,081,198,606 | 2,231,953,891 |
| 18 Health | 100,348,931 | 1,016,269,484 | 1,116,618,415 |
| **Total** | 1,336,785,995 | 16,889,799,311 | 18,226,585,307 |

**Table 3. Personal Income by Economic Sector for the TROA/WQSA Study Area by State**

| | California | Nevada | Total |
|---|---|---|---|
| | *$* | *$* | *$* |
| 1 Dairy Production | 162,284 | 4,659,403 | 4,821,687 |
| 2 Livestock Production | 108,785 | 4,419,544 | 4,528,329 |
| 3 Other Production Agriculture | 1,401,711 | 8,936,490 | 10,338,201 |
| 4 Other Hay | 0 | 168,389 | 168,389 |
| 5 Feed Grains | 0 | 168,538 | 168,538 |
| 6 Rest of Alfalfa | 7,035 | 6,176,911 | 6,183,946 |
| 7 Swingle Bench/ Hazen/Fernley Alfalfa | 0 | 126,420 | 126,420 |
| 8 Agricultural Services | 2,229,409 | 19,971,394 | 22,200,803 |
| 9 Gold Mining | 551,946 | 42,525,887 | 43,077,833 |
| 10 Other Mining | 1,384,652 | 24,798,051 | 26,182,704 |
| 11 Construction | 46,854,856 | 391,529,608 | 438,384,464 |
| 12 Manufacturing | 39,949,175 | 422,667,946 | 462,617,121 |
| 13 Transportation and Communications | 12,528,564 | 332,869,869 | 345,398,433 |
| 14 Utilities | 13,771,605 | 206,879,688 | 220,651,293 |
| 15 Trade | 53,868,103 | 670,224,132 | 724,092,235 |
| 16 Eating, Drinking | 11,448,022 | 85,629,462 | 97,077,485 |
| 17 Finance, Insurance, and Real Estate | 68,359,092 | 838,455,400 | 906,814,492 |
| 18 Hotels, Gaming, and Recreation | 11,273,139 | 369,637,840 | 380,910,979 |
| 19 Services | 45,407,467 | 662,059,358 | 707,466,824 |
| 20 Health | 34,689,366 | 358,316,956 | 393,006,322 |
| Total | 343,995,211 | 4,450,221,289 | 4,794,216,500 |

## Population

The population numbers for each county came from the 1990 Census of Population (30); the most recent actual population count. The 1990 Census of Population and Housing was used as they are consistent with one another and contain the most recent actual counts published by the Bureau of Census. Population estimates were available through 1997 but no consistent housing data, between the states of Nevada and California will be available until the next Census publication is released. With that in mind the assumption is made that population and housing ratios calculated in the models are the same as in 1990. All population was used for the Nevada counties while for the California counties only the percent population found in the TROA/WQSA study area are included. The population number allows the computation of a population coefficient based on value of output for each economic sector. This will allow for an estimate of increases and decreases in population based on economic activity. Table 4 illustrates the regional population for the TROA/WQSA study area.

## Housing

The total housing units from the 1990 Census of Housing (31) constitute occupied housing units. These housing units may be single, multi but less than ten or multi greater than ten units. A family or non-family household occupies the household units. Table 5 illustrates the housing units by economic sector for California, Nevada, and the TROA/WQSA study area. These housing units were derived based on the ratio of households in each county or subcounty to the population of each county or subcounty in the study area. Detailed tables showing number of dwellings, occupied household units, and household types by county can be found in Appendix B. These tables along with the county population were used to arrive at the final figures for housing units by economic sector and the housing coefficient used in the TROA/WQSA water transfer and recreational models (19). As explained in the population section of this report the 1990 Census was used for consistency in the data sets.

**Table 4. Population by Economic Sector for the Region by State.**

| Economic Sector | California all persons | Nevada all persons | Total all persons |
|---|---|---|---|
| 1 Dairy Production | 8 | 240 | 248 |
| 2 Livestock Production | 20 | 601 | 621 |
| 3 Other Production Agriculture | 102 | 217 | 319 |
| 4 Other Hay | 0 | 41 | 41 |
| 5 Feed Grains | 0 | 16 | 16 |
| 6 Rest of Alfalfa | 3 | 913 | 915 |
| 7 Swingle Bench/ Hazen/Fernley Alfalfa | 0 | 54 | 54 |
| 8 Agricultural Services | 471 | 3,075 | 3,545 |
| 9 Gold Mining | 38 | 1,087 | 1,125 |
| 10 Other Mining | 97 | 826 | 923 |
| 11 Construction | 5,416 | 21,995 | 27,411 |
| 12 Manufacturing | 3,302 | 22,562 | 25,864 |
| 13 Transportation and Communications | 1,231 | 16,474 | 17,705 |
| 14 Utilities | 308 | 2,380 | 2,688 |
| 15 Trade | 8,145 | 53,876 | 62,021 |
| 16 Eating, Drinking | 3,711 | 15,307 | 19,018 |
| 17 Finance, Insurance, and Real Estate | 4,090 | 21,254 | 25,344 |
| 18 Hotels, Gaming, and Recreation | 3,406 | 56,140 | 59,546 |
| 19 Services | 8,486 | 55,434 | 63,920 |
| 20 Health | 4,184 | 20,114 | 24,299 |
| **Total** | 43,017 | 292,606 | 335,623 |

**Table 5. Housing by Economic Sector for the TROA/WQSA Study Area by State**

| Economic Sector | California Dwellings | Nevada dwellings | Total dwellings |
|---|---|---|---|
| 1 Dairy Production | 3 | 103 | 106 |
| 2 Livestock Production | 8 | 258 | 266 |
| 3 Other Production Agriculture | 38 | 93 | 132 |
| 4 Other Hay | 0 | 18 | 18 |
| 5 Feed Grains | 0 | 7 | 7 |
| 6 Rest of Alfalfa | 1 | 393 | 394 |
| 7 Swingle Bench/ Hazen/Fernley Alfalfa | 0 | 23 | 23 |
| 8 Agricultural Services | 177 | 1,323 | 1,500 |
| 9 Gold Mining | 14 | 468 | 482 |
| 10 Other Mining | 36 | 355 | 392 |
| 11 Construction | 2,036 | 9,462 | 11,498 |
| 12 Manufacturing | 1,242 | 9,705 | 10,947 |
| 13 Transportation and Communications | 463 | 7,087 | 7,550 |
| 14 Utilities | 116 | 1,024 | 1,140 |
| 15 Trade | 3,063 | 23,176 | 26,238 |
| 16 Eating, Drinking | 1,396 | 6,584 | 7,980 |
| 17 Finance, Insurance, and Real Estate | 1,538 | 9,143 | 10,681 |
| 18 Hotels, Gaming, and Recreation | 1,281 | 24,150 | 25,430 |
| 19 Services | 3,191 | 23,846 | 27,037 |
| 20 Health | 1,573 | 8,652 | 10,226 |
| **Total** | 16,175 | 125,869 | 142,044 |

**Agricultural Water Use**

The agricultural water use is derived from the acre feet of water used to irrigate production cropland or the water required per cow for livestock. For crop production, total crop acreage is multiplied by the number of acre-feet needed for irrigation to arrive at total water usage. Table 6 shows the irrigated acreage for each crop production sector and the water application rates for those crops located in the TROA/WQSA study area.

To estimate water use by the livestock production sectors, the total number of cows (dairy and beef) is multiplied by the acre-feet of water needed per year. The assumption was made that beef cows require 15 gallons per day and dairy cows require 25 gallons per day as defined in the UNR Technical Report UCED 94-18 (19). Table 7 shows the acre-feet of water consumed per cow and the number of cows in the study area, while Table 8 shows the total water usage by production agriculture.

**Commercial Water Use**

Commercial water use is the amount of water, in acre-feet, needed to operate a commercial business. The base water use in gallons per day per employee were determined to be unchanged from the previous Truckee River Basin impact model by the Nevada Division of Water Planning (19). The total commercial water use figures are used to derive coefficients for determining the impacts of water transfers within the TROA/WQSA study area. Table 9 shows the distribution of commercial water use in the study area.

**Table 6. Irrigated Acreage and Water Use per Crop for the TROA/WQSA Study Area by State**

| Crop | California acres | Nevada acres | Total acres |
|---|---|---|---|
| Other Production Agriculture | 7,217 | 16,974 | 24,191 |
| Other Hay | 0 | 16,900 | 16,900 |
| Feed Grains | 0 | 3,427 | 3,427 |
| Rest of Alfalfa | 2,000 | 72,644 | 74,644 |
| Swingle Bench/ Hazen/Fernley Alfalfa | 0 | 5,956 | 5,956 |
| Total | 9,217 | 115,901 | 125,118 |

| Crop | acre-feet per acre | acre-feet per acre | acre-feet per acre |
|---|---|---|---|
| Other Production Agriculture | 3.54934651 | 3.97305267 | 3.76246739 |
| Other Hay | 3.54934651 | 3.97305267 | 3.76246739 |
| Feed Grains | 3.54934651 | 3.97305267 | 3.76246739 |
| Rest of Alfalfa | 3.54934651 | 3.97305267 | 3.76246739 |
| Swingle Bench/ Hazen/Fernley Alfalfa | 0.00000000 | 4.50000000 | 3.76246739 |

**Table 7. Number of Cows and Their Water Requirements for the TROA/WQSA Study Area by State**

| Type of Cow | California | Nevada | Total |
|---|---|---|---|
| | cows | cows | Cows |
| Beef Cow | 2,794 | 45,618 | 48,412 |
| Dairy Cow | 470 | 12,200 | 12,670 |
| | acre-feet/cow/year | acre-feet/cow/year | |
| Beef Cow | 0.01680216 | 0.01680216 | |
| Dairy Cow | 0.02800360 | 0.02800360 | |

**Table 8. Agriculture Water Use by Economic Sector for the TROA/WQSA Study Area by State**

| | Economic Sector | California acre-feet | Nevada acre-feet | Total acre-feet |
|---|---|---|---|---|
| 1 | Dairy Production | 25,629 | 68,203 | 93,832 |
| 2 | Livestock Production | 47 | 67,486 | 67,533 |
| 3 | Other Production Agriculture | 0 | 13,616 | 13,616 |
| 4 | Other Hay | 13 | 342 | 355 |
| 5 | Feed Grains | 0 | 13,616 | 13,616 |
| 6 | Rest of Alfalfa | 7,099 | 288,618 | 295,717 |
| 7 | Swingle Bench/ Hazen/Fernley Alfalfa | 0 | 26,802 | 26,802 |
| | **Total** | 32,788 | 478,683 | 511,470 |

**Table 9. Commercial Water Use by Economic Sector for the TROA/WQSA Study Area by State**

| Economic Sector | California | Nevada | Total |
|---|---|---|---|
| | Acre-feet | acre-feet | acre-feet |
| 1 Dairy Production | 0 | 8 | 8 |
| 2 Livestock Production | 0 | 20 | 20 |
| 3 Other Production Agriculture | 2 | 7 | 9 |
| 4 Other Hay | 0 | 1 | 1 |
| 5 Feed Grains | 0 | 1 | 1 |
| 6 Rest of Alfalfa | 0 | 30 | 30 |
| 7 Swingle Bench/ Hazen/Fernley Alfalfa | 0 | 2 | 2 |
| 8 Agricultural Services | 9 | 100 | 109 |
| 9 Gold Mining | 0 | 8 | 8 |
| 10 Other Mining | 0 | 7 | 7 |
| 11 Construction | 41 | 286 | 327 |
| 12 Manufacturing | 52 | 619 | 671 |
| 13 Transportation and Communications | 15 | 360 | 376 |
| 14 Utilities | 28 | 372 | 399 |
| 15 Trade | 119 | 1,362 | 1,481 |
| 16 Eating, Drinking | 157 | 1,126 | 1,283 |
| 17 Finance, Insurance, and Real Estate | 35 | 317 | 352 |
| 18 Hotels, Gaming, and Recreation | 240 | 6,858 | 7,098 |
| 19 Services | 187 | 2,126 | 2,314 |
| 20 Health | 138 | 1,155 | 1,294 |
| **Total** | 1,024 | 14,766 | 15,790 |

**Residential Water Use**

Residential water use is that water used for household consumption. This can range from household drinking water to lawn watering. The residential water use was assumed to be the same per household as in the previous Truckee River Basin impact model (19) based on discussions with Sierra Pacific Power Company (formerly Westpac Utilities). Table 10 shows the total distribution of metered and non-metered residential water requirements for the TROA/WQSA study area along with the ratio of the two.

## TROA/WQSA Study Area Totals

The following tables are a summary of all control totals and demographic data used in the TROA/WQSA social accounting impact model and the revised water transfer and recreational impact models (19). Table 11 shows the region wide control totals as actual values derived from the previous tables and those in Appendix B.

By using the dollars worth of output totals, output response coefficients were derived for each of the demographic statistics for the study area. Each demographic statistic is divided by the output for each economic sector. These coefficients will allow an estimation of impacts to things such as water use, housing and population changes. For example if there is an increase in trade sector output the models will be able to estimate the total jobs supported by that increase, population increases, and the number of dwellings needed to support those new jobs. Table 12 shows the output response coefficients for the study area. These are interpreted, as for every dollar increase/decrease in output; the demographics will increase/decrease by a certain amount. For example, every additional dollar of dairy production output, agricultural water use in dairy production would increase by .0035 acre-feet.

**Table 10. Ratio of Metered Residential Water Use to Residential Water Use by Economic Sector for the TROA/WQSA Study Area.**

| Economic Sector | Metered Residential Water Use acre-feet | Residential Water Use acre-feet | Ratio |
|---|---|---|---|
| 1 Dairy Production | 47 | 63 | 0.75467059 |
| 2 Livestock Production | 118 | 157 | 0.75466353 |
| 3 Other Production Agriculture | 59 | 78 | 0.75361106 |
| 4 Other Hay | 8 | 10 | 0.75477956 |
| 5 Feed Grains | 3 | 4 | 0.75477956 |
| 6 Rest of Alfalfa | 175 | 232 | 0.75476975 |
| 7 Swingle Bench/ Hazen/Fernley Alfalfa | 10 | 14 | 0.75477956 |
| 8 Agricultural Services | 667 | 884 | 0.75430429 |
| 9 Gold Mining | 214 | 284 | 0.75465948 |
| 10 Other Mining | 174 | 231 | 0.75440570 |
| 11 Construction | 5,119 | 6,788 | 0.75406691 |
| 12 Manufacturing | 4,870 | 6,457 | 0.75432275 |
| 13 Transportation and Communications | 3,357 | 4,449 | 0.75453237 |
| 14 Utilities | 507 | 672 | 0.75437044 |
| 15 Trade | 11,674 | 15,476 | 0.75430943 |
| 16 Eating, Drinking | 3,553 | 4,711 | 0.75407586 |
| 17 Finance, Insurance, and Real Estate | 4,753 | 6,303 | 0.75419982 |
| 18 Hotels, Gaming, and Recreation | 11,307 | 14,984 | 0.75457650 |
| 19 Services | 12,029 | 15,948 | 0.75430423 |
| 20 Health | 4,551 | 6,035 | 0.75416020 |
| Total | 63,196 | 83,779 | 0.75432089 |

**Table 11. Control Totals by Economic Sector for the TROA/WQSA Study Area**

| | | Output | Employment | Income | Population | Housing | Agriculture Water Use | Commercial Water Use | Residential Water |
|---|---|---|---|---|---|---|---|---|---|
| | | *$* | *jobs* | *$* | *all persons* | *dwellings* | *acre-feet* | *acre-feet* | *acre-feet* |
| 1 | Dairy Production | 26,436,640 | 167 | 4,821,687 | 248 | 106 | 93,832 | 8 | 63 |
| 2 | Livestock Production | 31,168,676 | 418 | 4,528,329 | 621 | 266 | 67,533 | 20 | 157 |
| 3 | Other Production Agriculture | 31,583,720 | 188 | 10,338,201 | 319 | 132 | 13,616 | 9 | 78 |
| 4 | Other Hay | 2,531,060 | 28 | 168,389 | 41 | 18 | 355 | 1 | 10 |
| 5 | Feed Grains | 636,010 | 11 | 168,538 | 16 | 7 | 13,616 | 1 | 4 |
| 6 | Rest of Alfalfa | 32,196,998 | 624 | 6,183,946 | 915 | 394 | 295,717 | 30 | 232 |
| 7 | Swingle Bench /Hazen/Fernley Alfalfa | 2,025,040 | 37 | 126,420 | 54 | 23 | 26,802 | 2 | 14 |
| 8 | Agricultural Services | 48,768,844 | 2,284 | 22,200,803 | 3,545 | 1,500 | 0 | 109 | 884 |
| 9 | Gold Mining | 206,315,997 | 757 | 43,077,833 | 1,125 | 482 | 0 | 8 | 284 |
| 10 | Other Mining | 76,387,751 | 602 | 26,182,704 | 923 | 392 | 0 | 7 | 231 |
| 11 | Construction | 1,750,667,095 | 17,145 | 438,384,464 | 27,411 | 11,498 | 0 | 327 | 6,788 |
| 12 | Manufacturing | 2,580,037,987 | 16,701 | 462,617,121 | 25,864 | 10,947 | 0 | 671 | 6,457 |
| 13 | Transportation and Communications | 1,288,367,289 | 11,731 | 345,398,433 | 17,705 | 7,550 | 0 | 376 | 4,449 |
| 14 | Utilities | 656,690,163 | 1,746 | 220,651,293 | 2,688 | 1,140 | 0 | 399 | 672 |
| 15 | Trade | 2,340,134,250 | 39,983 | 724,092,235 | 62,021 | 26,238 | 0 | 1,481 | 15,476 |
| 16 | Eating, Drinking | 420,839,282 | 11,909 | 97,077,485 | 19,018 | 7,980 | 0 | 1,283 | 4,711 |
| 17 | Finance, Insurance, and Real Estate | 3,021,910,833 | 16,118 | 906,814,492 | 25,344 | 10,681 | 0 | 352 | 6,303 |
| 18 | Hotels, Gaming, and Recreation | 2,361,315,366 | 39,666 | 380,910,979 | 59,546 | 25,430 | 0 | 7,098 | 14,984 |
| 19 | Services | 2,231,953,891 | 41,181 | 707,466,824 | 63,920 | 27,037 | 0 | 2,314 | 15,948 |
| 20 | Health | 1,116,618,415 | 15,377 | 393,006,322 | 24,299 | 10,226 | 0 | 1,294 | 6,035 |
| | Total | 18,226,585,307 | 216,673 | 4,794,216,500 | 335,623 | 142,044 | 511,470 | 15,790 | 83,779 |

**Table 12. Output Response Coefficients by Economic Sector for the TROA/WQSA Study Area**

| | Economic Sector | Output<br>*$*<br>*$ of output* | Employment<br>*jobs /*<br>*$ of output* | Income<br>*Personal Income /*<br>*$ of output* | Population<br>*all persons /*<br>*$ of output* | Housing<br>*dwellings /*<br>*$ of output* | Agriculture Water Use<br>*acre-feet /*<br>*$ of output* | Commercial Water Use<br>*acre-feet /*<br>*$ of output* | Residential Water Use<br>*acre-feet /*<br>*$ of output* |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Dairy Production | 1.00000000 | 0.00000632 | 0.18238655 | 0.00000938 | 0.00000402 | 0.00354931 | 0.00000030 | 0.00000237 |
| 2 | Livestock Production | 1.00000000 | 0.00001341 | 0.14528460 | 0.00001992 | 0.00000853 | 0.00216670 | 0.00000064 | 0.00000503 |
| 3 | Other Production Agriculture | 1.00000000 | 0.00000595 | 0.32732689 | 0.00001009 | 0.00000416 | 0.00043110 | 0.00000028 | 0.00000246 |
| 4 | Other Hay | 1.00000000 | 0.00001106 | 0.06652918 | 0.00001620 | 0.00000697 | 0.00014018 | 0.00000053 | 0.00000410 |
| 5 | Feed Grains | 1.00000000 | 0.00001730 | 0.26499278 | 0.00002533 | 0.00001090 | 0.02140792 | 0.00000083 | 0.00000642 |
| 6 | Rest of Alfalfa | 1.00000000 | 0.00001938 | 0.19206593 | 0.00002842 | 0.00001222 | 0.00918462 | 0.00000093 | 0.00000720 |
| 7 | Swingle Bench /Hazen/Fernley Alfalfa | 1.00000000 | 0.00001827 | 0.06242862 | 0.00002676 | 0.00001151 | 0.01323529 | 0.00000087 | 0.00000678 |
| 8 | Agricultural Services | 1.00000000 | 0.00004683 | 0.45522512 | 0.00007269 | 0.00003075 | 0.00000000 | 0.00000224 | 0.00001814 |
| 9 | Gold Mining | 1.00000000 | 0.00000367 | 0.20879541 | 0.00000545 | 0.00000234 | 0.00000000 | 0.00000004 | 0.00000138 |
| 10 | Other Mining | 1.00000000 | 0.00000788 | 0.34276050 | 0.00001208 | 0.00000513 | 0.00000000 | 0.00000009 | 0.00000302 |
| 11 | Construction | 1.00000000 | 0.00000979 | 0.25040995 | 0.00001566 | 0.00000657 | 0.00000000 | 0.00000019 | 0.00000388 |
| 12 | Manufacturing | 1.00000000 | 0.00000647 | 0.17930632 | 0.00001002 | 0.00000424 | 0.00000000 | 0.00000026 | 0.00000250 |
| 13 | Transportation and Communications | 1.00000000 | 0.00000911 | 0.26809004 | 0.00001374 | 0.00000586 | 0.00000000 | 0.00000029 | 0.00000345 |
| 14 | Utilities | 1.00000000 | 0.00000266 | 0.33600518 | 0.00000409 | 0.00000174 | 0.00000000 | 0.00000061 | 0.00000102 |
| 15 | Trade | 1.00000000 | 0.00001709 | 0.30942337 | 0.00002650 | 0.00001121 | 0.00000000 | 0.00000063 | 0.00000661 |
| 16 | Eating, Drinking | 1.00000000 | 0.00002830 | 0.23067591 | 0.00004519 | 0.00001896 | 0.00000000 | 0.00000305 | 0.00001119 |
| 17 | Finance, Insurance, and Real Estate | 1.00000000 | 0.00000533 | 0.30007983 | 0.00000839 | 0.00000353 | 0.00000000 | 0.00000012 | 0.00000209 |
| 18 | Hotels, Gaming, and Recreation | 1.00000000 | 0.00001680 | 0.16131305 | 0.00002522 | 0.00001077 | 0.00000000 | 0.00000301 | 0.00000635 |
| 19 | Services | 1.00000000 | 0.00001845 | 0.31697197 | 0.00002864 | 0.00001211 | 0.00000000 | 0.00000104 | 0.00000715 |
| 20 | Health | 1.00000000 | 0.00001377 | 0.35196117 | 0.00002176 | 0.00000916 | 0.00000000 | 0.00000116 | 0.00000540 |

**Overview of Social Accounting Matrix**

Numerous studies have employed social accounting matrices to provide a comprehensive framework for studying the composition of national income. The institutional structure of the social accounts represent, via the social accounting matrix (SAM), a detailed itemization of the sources and destinations of income flows throughout the economy. The SAM framework also reconciles the two main sources of economy wide information, national income and product accounts, which reflect macro-economic aggregates, and input-output accounts, which reflect the composition of production. Such an accounting perspective, at once disaggregated and closed-form, gives a more detailed and complete model of income determination than has been obtained by traditional macro-economic and input-output models.

The disaggregated nature of the SAM framework makes it attractive for distributional studies. Its tableau format emphasizes economic linkages, revealing the complex underlying structure of income determination. The growing literature on SAM based multipliers is promoting a deeper structural analysis of the determinants of nominal income, but modeling of relative incomes has received less attention.

Numerous studies using SAM have been from a national focus (1, 6, 8, 9, 10, 12, and 21). However, formulation of single county, multiple county, and statewide SAM models have only recently been developed (5, 15, 18). These studies provide more distributional analysis as to impacts in a regional economy from changes in national or resource policies.

## STRUCTURE OF THE SOCIAL ACCOUNTING MATRIX

The basic structure of a SAM follows the National Income and Product Account. The major categories of a SAM are production, consumption, accumulation and trade accounts. These main accounts are broken down into several small sub-accounts. Although there tends to be considerable variation in the specification of sub-accounts for any given SAM, the major accounts are common to all SAMs.

### Production Accounts

The production accounts are composed of production activities and factors of production. Activities use commodities in the form of goods and services to produce commodities. For the version of SAM in this paper, separate commodity and activity accounts that form a more disaggregated SAM have been combined into activity accounts alone.

The factors of production accounts relate to the primary factors that are used in an economy in the production process. They are often referred to as the value-added accounts that are used extensively in input-output analysis. Traditionally they are comprised of land, labor and capital. The factor accounts are paid by activities when production takes place.

Reading across an activity row, total commodity demand can be determined. It is composed of commodities consumed by activities in production, household consumption, government consumption, investments and exports. The consumption of commodities by activities is referred to as intermediate demand and is used in forming the technical requirements matrix. The activities column shows expenditures or inputs used in the production process, value-added payments to primary factors and taxes paid to the government. Value-added refers to total input purchases of an activity minus its inputs purchased from other activities. Value added consists of payments to households for labor and returns to capital. The sum of all the inputs used in production must equal gross domestic production at factor cost. The sum of all factor payments comprises gross factor incomes.

These incomes are in turn redistributed to what are called institutional accounts in the value-added columns. The rows and columns for factors of production both sum to gross factor incomes and must equal each other so that all the income received by a given factor is distributed to the institutional accounts.

The institution accounts receive factor income from the value-added accounts and distribute it to government, household, or capital (saving) accounts. The enterprises institution represents incorporated business and receives income in the form of returns to capital and depreciation allowances. This institution pays part of these returns back to household in the form of dividends, interest and rent. Depreciation and retained earnings are the basis for enterprise contribution to the capital or savings row.

**Consumption Accounts**

The consumption accounts consist of households and government, and are a major component of the final demand accounts. The columns for the accounts of households, for example, sum to gross expenditures and consist of household expenditures on goods and services, payments of direct taxes, as well as savings and gross transfers abroad. The rows for households represent gross receipts from labor, proprietor's income, receipts for capital earnings from enterprises, receipts from government transfers, and earnings from abroad. Gross household receipts must equal gross household expenditures. Household income in many of the U.S. SAM is distinguished according to the size distribution of income. Often a distinction is made between income going to rural and urban households.

**Accumulation Accounts**

The accumulation accounts record capital investment and change in stocks in the column and savings from households, enterprises and government as well as the balance of foreign trade on capital accounts in the row. The savings from enterprises, households, and government accounts are all combined into one row that shows the source of capital payments. Investment is financed by savings of domestic institutions and foreign financing through the balance of payments, such that gross capital receipts and capital payments equate.

**Trade Accounts and the Treatment of Imports**

The trade accounts show U.S. economic interactions with the rest of the world. There are two separate trade accounts, one representing outflows of goods and services (exports) and inflows of money; the other representing inflows of goods and services and outflows of money. The trade row shows the outflows of revenue to other countries in the purchase of imports and

transfers abroad from institutions. The trade column shows the inflows of revenue from other countries from the purchase of U.S. exports. Once again, gross payments abroad must equal gross current receipts from abroad. A mathematical presentation of the Social Accounting Matrix is presented in Appendix A.

The TROA/WQSA Study Area Social Accounting Model used data supplied by IMPLAN to develop an initial model (2, 21). The IMPLAN Model data was adjusted to reflect TROA/WQSA area conditions. These adjustments were:

1. adjusting the agricultural sectors by using Nevada Agricultural Statistics data.
2. adding an alfalfa hay sector to reflect Fernley, Swingle Bench, and Hazen area conditions based on crop cost and return estimates; and
3. adjusting employment and income data to conform to Regional Economic Information System data (28).

After these adjustments were made, a TROA /WQSA Study Area Social Accounting Model was developed for Windows applications.

## SAM and Input-Output Models

Social Accounting Models provide detailed flow of income to households and other institutions in the institutional accounts of SAM models. However, many regional and sub-regional models are input-output models, which are more aggregated than SAM models in regards to household flows.

The previous study of the TROA area (19) employed input-output, not SAM modeling procedures. Employing procedures outlined by Holland and Wyeth (16) and the IMPLAN User's Manual (20), the TROA Social Accounting Model can be transformed in to the TROA input-output model.

## Fiscal Impact Modeling

During the 1980's and 1990's counties in the United States recognized rapid population and economic growth. However, with this rapid growth, many communities have realized a strain on their community services and budgets. Unlike many metropolitan areas, rural counties of the mountain states do not have personnel to help rural decision-makers analyze and predict future economic growth and consequential demand on local community services. In fact, rural decision-makers such as county commissioners are part-time public officials whose decisions pertaining to the future are complex and sometimes overbearing.

Rural decision-makers have requested assistance in analyzing current and potential economic trends and their impacts on local government fiscal balances. To assist rural decision-makers, various socio-economic/fiscal models have been developed and used by cooperative extension. The IMPLAN input-output microcomputer software (2, 20) has been used by numerous researchers and extension personnel to assist rural decision makers in estimating economic impacts of exogenous changes to a local community. Other models have been developed to incorporate estimates of economic change and derive consequential fiscal impact to local governments (3, 11, 16, 23, 26, and 27).

Following procedures outlined by Johnson et al. (17) research, regression procedures were used to estimate county level expenditures and revenues from changes in place of work employment. As opposed to Johnson et al. (17) county regression models were tested for difference in results from place of work and place of residence employment. Results showed no statistical differences between place of work and place of residence employment variables. Therefore, place of work employment will be used in this analysis. Place of work employment would be preferred since input-output and social accounting matrix models forecast employment impacts by place of employment. The employment figures used in this analysis were obtained from the REIS data set for 1995. Total employment for the study area must be used as there is no way to arrive at sub-county revenue and expenditure data for California, therefore the total employment of 214,204 jobs (34) was used for the five county area. The total Nevada, three county, regional employment was 223,290 jobs (34).

Following Hirsch (14, 15); Stinson (25); and Stinson and Labov (26), cost of public services is hypothesized to be a function of the level and quality of services. Using Census of Government data (32), public expenditures and revenue data were collected.

For county expenditures, total county expenditure and revenue data from the Census of Government (33) were used. A detailed analysis of the fiscal model is presented in a referenced study by Harris et al. (28).

**Total County Expenditures:**

The following county government expenditure equation was derived which can estimate costs in the TROA/WQSA study area.

Nevada

(1a) $CEXP = 9.919255 + 0.7216\,LW9$

California

(1b) $CEXP = 3.8608 + 0.70896\,LW9$

Where: CEXP is the log value of county total expenditures.
LW9 is the log value of place of work employment.

From equation 1, a one percent increase in place of work employment yields a 0.7216% change in total county government expenditures for the Nevada Counties. The amount of county government expenditures will be shown as an increase or decrease given a change in model employment. This number is based upon a total beginning county expenditure, for Churchill, Lyon and Washoe, of $233,582,000.00 as taken from the Census of Government (33) and $385,282,196.00 for Alpine, El Dorado, Nevada, Placer, and Sierra Counties in California.

**Total County Revenues:**

This equation will be used to derive total county government revenues from changes in local place of work employment.

Nevada

(2a) LTR = 9.955225 + 0.7763LW9

California

(2b) LTR = 3.9859 + 0.69802LW9

Where:

LTR is the log value of total county revenues.

LW9 is log value of place of work employment.

A statistical procedure called Box-Cox was used and results suggest that the data support a logarithm functional form; hence all equations are logarithmic. Therefore, using the place of work employment variable results indicate a one percent change in place of work employment yields a 0.69802% change in total county government revenues for California counties. The amount of county government revenues will reflect an increase or decrease based upon a given change in employment. Once again the base revenues of $248,184,000.00 were taken from the Census of Governments (33) for Churchill, Lyon and Washoe Counties in Nevada and $374,769,810.00 for Alpine, El Dorado, Nevada, Placer, and Sierra Counties in California.

**Limitations of Fiscal Models:**

In using the fiscal equations developed from the Great Basin fiscal model certain limitations should be kept in mind. First, cross–section regression represents average relationships across a large number of jurisdictions. Local factors, such as excess capacity in the county's infrastructure can be incorporated in on a case by case basis, based on local conditions. Second, fiscal impacts are assumed to occur the same year as the exogenous impacts. It is likely that expenditures for a given exogenous change will be needed before the change occurs and revenue increases may occur some time later. Therefore case by case adjustments may be appropriate for a given analysis.

## TROA/WQSA Study Area Economic Impact Model

The TROA/WQSA Study Area Economic Impact Model is a fully functional Windows application. A computer running under a Windows© platform (Windows 3.1, Windows 95©, Windows 98©, and Windows NT©) and at least five megabytes of hard disk space are needed to install and operate the impact model. The user enters values representing "shocks" to the economy in terms of final demand or industry output. The values entered are then used to derive economic impacts for the study area, changes in household income, and employment. The program has a menu used for entering data, calculating impacts, printing output and saving data. Figure 2 shows the title screen of the impact model.

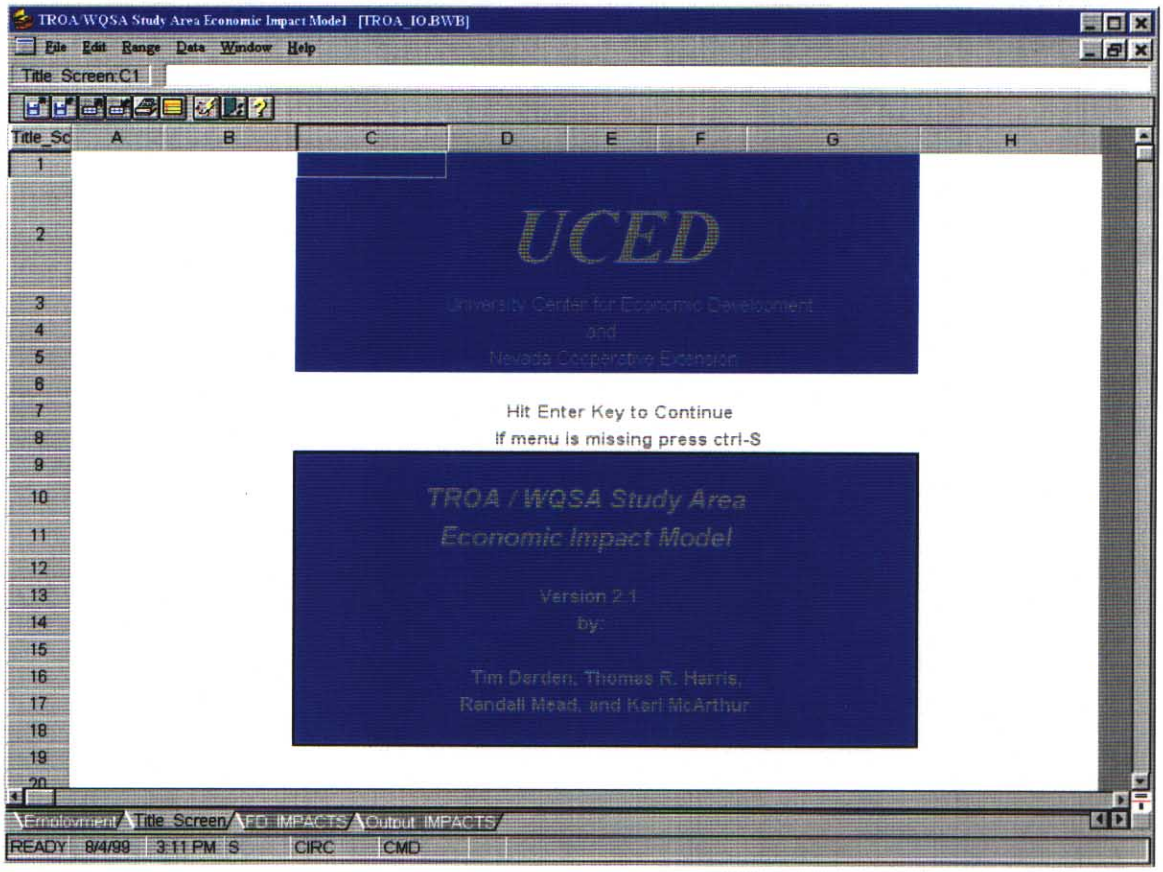



**Figure 2. TROA/WQSA Study Area Social Accounting Impact Model Title Screen.**

**Program Installation**

To install the program under the Windows 95© platform run the setup.exe program. To do this click on "Start" then "Run" from the program window and type "A:\Setup" or follow the instructions for your version of Windows©. The install wizard will guide the user through the installation and setup of the program. The installation will create a program group with icons and a copy of this document in Adobe Acrobat© format. To uninstall the programs simply go to the "Control Panel", select "Add/Remove Programs" and find the TROA/WQSA software and select remove. For more information please refer to your Windows User's Guide.

**Program Menu**

The primary TROA/WQSA Economic Impact model will automatically open upon starting the program and the title screen will appear. Once the user "clicks" the mouse or strikes a key on the keyboard a menu as seen in Figure 3 will open. The menu contains eight options, an OK, Cancel and Help button. The eight available options consist of:

1. FD Changes – Final demand changes.

2. Calculate FD – Final demand impact calculation.

3. Output Changes – Output changes.

4. Calculate Output – Output impact calculation.

5. Change Employment - Change Employment Allocation for Fiscal Impacts

6. Print FD – Print final demand impact table.

7. Print Output – Print output impact table.

8. Quit – Exit the model.

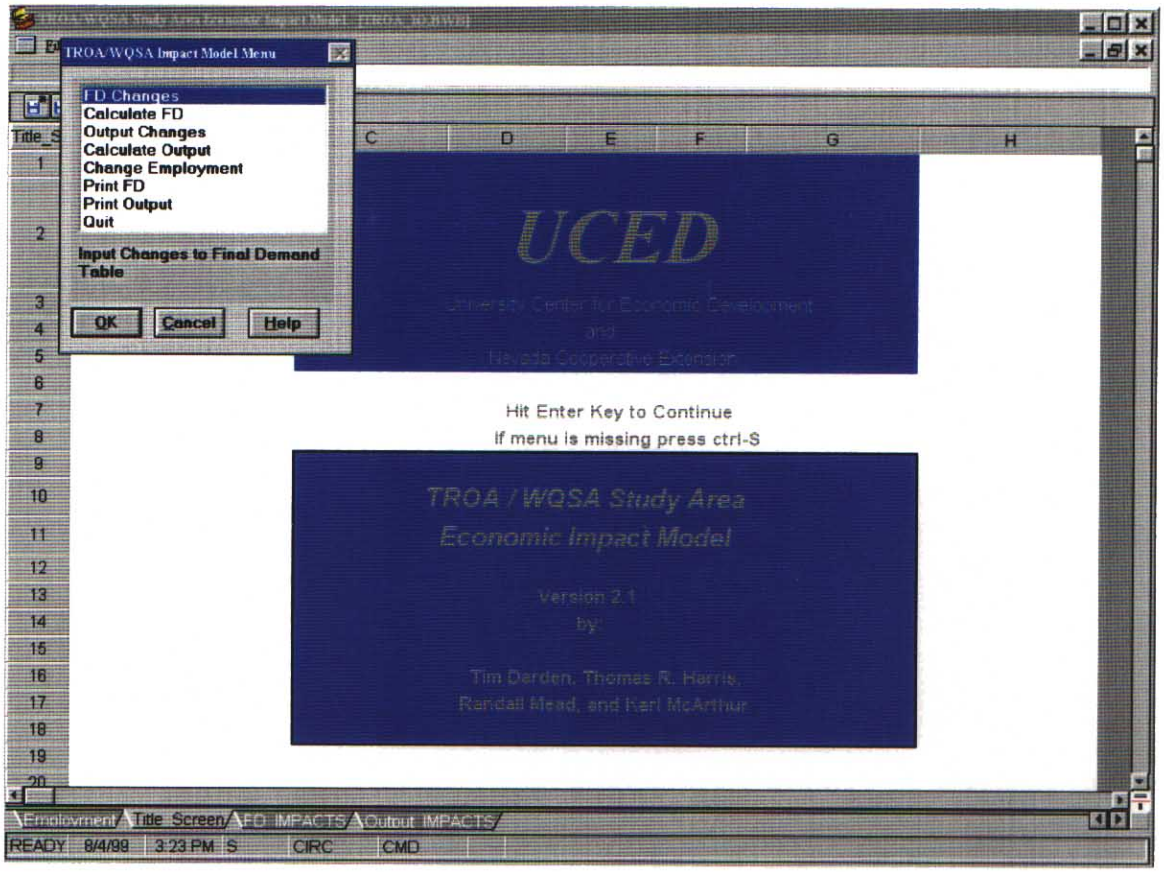



**Figure 3. TROA/WQSA Study Area Impact Model Menu.**

The OK button works the same as double clicking with the mouse, or pressing enter on the keyboard while trying to execute a menu item. The Cancel button works to allow the user to exit from the menu and move around or look at the tables in the model, however there are limits to changes that can be made. *If the menu is cancelled for any reason it will not reappear until the user presses Ctrl and S on the keyboard simultaneously.*

Finally, the Help button is used to bring up the custom help file for use in operating the program or finding definitions of terms used in the impact model program.

**Estimation of Final Demand Changes**

To calculate final demand impacts with the TROA/WQSA Economic Impact Model the user clicks on the FD Changes option located at the top of the menu. The screen will now show the final demand impact table and allow the user to enter a value in the "Direct Final Demand Impacts" column only (Figure 4). In this example the analysis calls for a $500,000 increase in final demand sales for the Trade sector in the TROA area economy. The impacts do not have to occur in only one economic sector. Enter as many values as needed to accurately estimate an impact.

After entering the desired economic "shocks" the user can strike the enter key or click anywhere on the screen to bring the model menu back. The user should then select the "Calculate FD" option and calculate the final demand impacts.

Table 13 shows the impacts calculated by the model for a $500,000 increase in final demand trade sales of the TROA/WQSA study area (Table 13). This change in the economy yields a total economic impact of $1,031,703. Employment impacts are shown as a total of 12 jobs in the TROA/WQSA study area supported by this increase in economic activity.

Distributional impacts are also shown to give the user an idea of where in the economy the impacts are taking place and to show the interaction between the directly impacted economic sector(s) and the rest of the study area economy. The bottom portion of Table 13 shows a summary of the total impacts by industry, household income, employment, and total economic impacts. Fiscal impacts are also derived showing total county revenues and total county expenditures, by state, for the TROA/WQSA study area and are given at the bottom of Table 13. For the $500,000 increase in trade sector final demand, total county expenditures increase by an

estimated $5,382 in Nevada and $1 in California counties using a 92% Nevada and 8% California employment split.

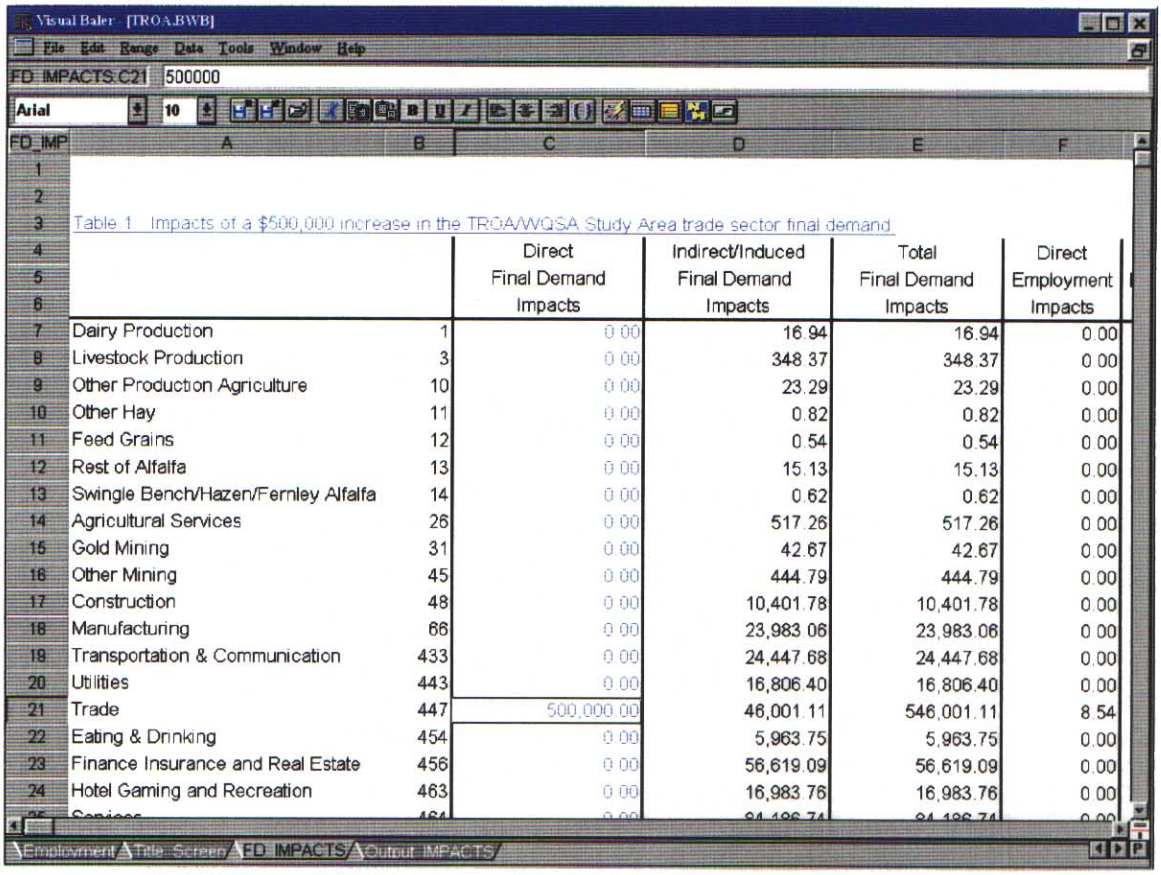



**Figure 4. Final Demand Change Analysis Screen (FD Changes Menu Item).**

Table 1. Impacts of a $500,000 increase in the TROA/WQSA Study Area trade sector final demand.

| | | Direct Final Demand Impacts | Indirect/Induced Final Demand Impacts | Total Final Demand Impacts | Direct Employment Impacts | Total Employment Impacts |
|---|---|---|---|---|---|---|
| Dairy Production | 1 | 0.00 | 15.86 | 15.86 | 0.00 | 0.00 |
| Livestock Production | 3 | 0.00 | 318.69 | 318.69 | 0.00 | 0.00 |
| Other Production Agriculture | 10 | 0.00 | 20.94 | 20.94 | 0.00 | 0.00 |
| Other Hay | 11 | 0.00 | 0.76 | 0.76 | 0.00 | 0.00 |
| Feed Grains | 12 | 0.00 | 0.50 | 0.50 | 0.00 | 0.00 |
| Rest of Alfalfa | 13 | 0.00 | 13.56 | 13.56 | 0.00 | 0.00 |
| Swingle Bench/Hazen/Fernley Alfalfa | 14 | 0.00 | 0.19 | 0.19 | 0.00 | 0.00 |
| Agricultural Services | 26 | 0.00 | 478.45 | 478.45 | 0.00 | 0.02 |
| Gold Mining | 31 | 0.00 | 39.75 | 39.75 | 0.00 | 0.00 |
| Other Mining | 45 | 0.00 | 417.01 | 417.01 | 0.00 | 0.00 |
| Construction | 48 | 0.00 | 9,626.63 | 9,626.63 | 0.00 | 0.09 |
| Manufacturing | 66 | 0.00 | 22,473.37 | 22,473.37 | 0.00 | 0.15 |
| Transportation & Communication | 433 | 0.00 | 22,698.55 | 22,698.55 | 0.00 | 0.21 |
| Utilities | 443 | 0.00 | 15,686.34 | 15,686.34 | 0.00 | 0.04 |
| Trade | 447 | 500,000.00 | 41,898.82 | 541,898.82 | 8.54 | 9.26 |
| Eating & Drinking | 454 | 0.00 | 5,240.88 | 5,240.88 | 0.00 | 0.15 |
| Finance Insurance and Real Estate | 456 | 0.00 | 52,912.26 | 52,912.26 | 0.00 | 0.28 |
| Hotel Gaming and Recreation | 463 | 0.00 | 15,203.08 | 15,203.08 | 0.00 | 0.26 |
| Services | 464 | 0.00 | 79,104.13 | 79,104.13 | 0.00 | 1.46 |
| Health | 490 | 0.00 | 25,917.99 | 25,917.99 | 0.00 | 0.36 |
| Households | | 0.00 | 239,635.41 | 239,635.41 | 0.00 | 0.00 |

| | Direct Impacts | Indirect/Induced Impacts | Total Impacts |
|---|---|---|---|
| Total Industry Impacts | $500,000.00 | $292,067.77 | $792,067.77 |
| Total Household Income Impact | | $239,635.41 | $239,635.41 |
| Total Employment Impacts | | | 12 |
| Total Economic Impacts | $500,000.00 | $531,703.18 | $1,031,703.18 |

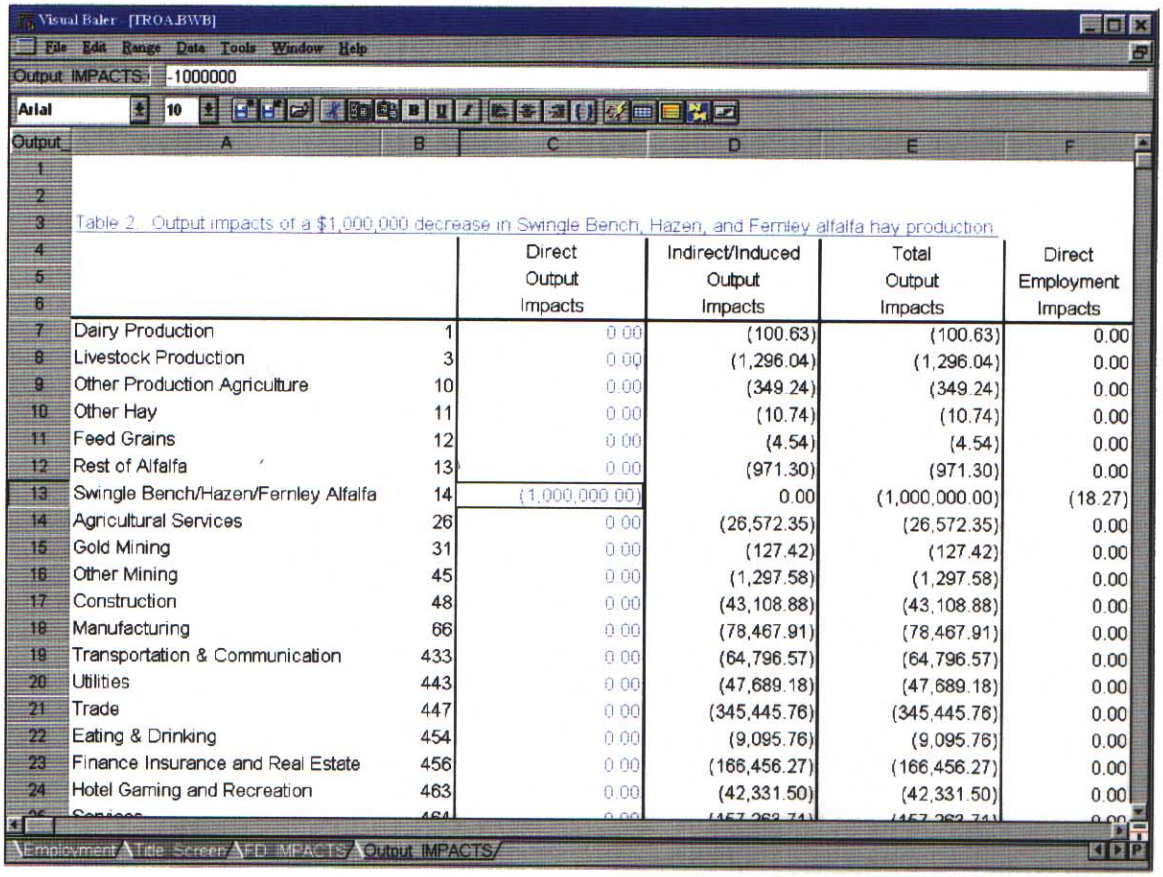
| | |
|---|---|
| Nevada Employment % | 92% |
| California Employment % | 8% |
| Change in County Expenditures - Nevada Counties | $5,382 |
| Change in County Revenues - Nevada Counties | $11,773 |
| Change in County Expenditures - California Counties | $1 |
| Change in County Revenues - California Counties | $1 |

**Table 13. Final Demand Impacts Derived from UCED Impact Software**

**Estimation of Output Changes**

To use the TROA/WQSA Economic Impact Model to derive impacts from output changes the user clicks on the "Output Changes" option (see Figure 3) which will transfer the user to the output impacts screen as shown in Figure 5. For this example the user assumes a decrease of $1,000,000 in Fernley, Swingle Bench, and Hazen alfalfa output. After inputting the $1,000,000 decrease in the direct impact column the economic impacts are calculated by striking the enter key and clicking on the "Calculate Output" option from the menu.

Table 14 shows that with a $1,000,000 decrease in output from the Fernley, Swingle Bench, and Hazen alfalfa sector there will be an extra $971,078 decrease in industrial economic activity through indirect and induced effects for a total negative industry impact of $1,971,078. Household income will decrease by $348,060 with most of that decrease coming in the medium and high-income level households. Also, total employment is expected to decrease by 32 jobs. Once again the table shows distributional impacts to industry, value added, household income, employment, total county revenues, and total county expenditures in a summary at the bottom of the table. For a $1,000,000 decrease in Fernley, Hazen, and Swingle Bench alfalfa there would be a decrease of $30,399 in Nevada county revenues and $2 in California county revenues with a 92% / 8% employment split.




| | | Direct Output Impacts | Indirect/Induced Output Impacts | Total Output Impacts | Direct Employment Impacts |
|---|---|---|---|---|---|
| Dairy Production | 1 | 0.00 | (100.63) | (100.63) | 0.00 |
| Livestock Production | 3 | 0.00 | (1,296.04) | (1,296.04) | 0.00 |
| Other Production Agriculture | 10 | 0.00 | (349.24) | (349.24) | 0.00 |
| Other Hay | 11 | 0.00 | (10.74) | (10.74) | 0.00 |
| Feed Grains | 12 | 0.00 | (4.54) | (4.54) | 0.00 |
| Rest of Alfalfa | 13 | 0.00 | (971.30) | (971.30) | 0.00 |
| Swingle Bench/Hazen/Fernley Alfalfa | 14 | (1,000,000.00) | 0.00 | (1,000,000.00) | (18.27) |
| Agricultural Services | 26 | 0.00 | (26,572.35) | (26,572.35) | 0.00 |
| Gold Mining | 31 | 0.00 | (127.42) | (127.42) | 0.00 |
| Other Mining | 45 | 0.00 | (1,297.58) | (1,297.58) | 0.00 |
| Construction | 48 | 0.00 | (43,108.88) | (43,108.88) | 0.00 |
| Manufacturing | 66 | 0.00 | (78,467.91) | (78,467.91) | 0.00 |
| Transportation & Communication | 433 | 0.00 | (64,796.57) | (64,796.57) | 0.00 |
| Utilities | 443 | 0.00 | (47,689.18) | (47,689.18) | 0.00 |
| Trade | 447 | 0.00 | (345,445.76) | (345,445.76) | 0.00 |
| Eating & Drinking | 454 | 0.00 | (9,095.76) | (9,095.76) | 0.00 |
| Finance Insurance and Real Estate | 456 | 0.00 | (166,456.27) | (166,456.27) | 0.00 |
| Hotel Gaming and Recreation | 463 | 0.00 | (42,331.50) | (42,331.50) | 0.00 |

**Figure 5. Output Change Analysis Screen (Output Changes Menu Item)**

Table 2. Output Impacts of a $1,000,000 decrease in Swingle Bench, Hazen, and Fernley alfalfa hay production.

| | | Direct Output Impacts | Indirect/Induced Output Impacts | Total Output Impacts | Direct Employment Impacts | Total Employment Impacts |
|---|---|---|---|---|---|---|
| Dairy Production | 1 | 0.00 | (97.66) | (97.66) | 0.00 | (0.00) |
| Livestock Production | 3 | 0.00 | (1,217.99) | (1,217.99) | 0.00 | (0.02) |
| Other Production Agriculture | 10 | 0.00 | (342.25) | (342.25) | 0.00 | (0.00) |
| Other Hay | 11 | 0.00 | (10.55) | (10.55) | 0.00 | (0.00) |
| Feed Grains | 12 | 0.00 | (4.42) | (4.42) | 0.00 | (0.00) |
| Rest of Alfalfa | 13 | 0.00 | (964.79) | (964.79) | 0.00 | (0.02) |
| Swingle Bench/Hazen/Fernley Alfalfa | 14 | (1,000,000.00) | 0.00 | (1,000,000.00) | (18.27) | (18.27) |
| Agricultural Services | 26 | 0.00 | (26,405.19) | (26,405.19) | 0.00 | (1.24) |
| Gold Mining | 31 | 0.00 | (119.70) | (119.70) | 0.00 | (0.00) |
| Other Mining | 45 | 0.00 | (1,223.84) | (1,223.84) | 0.00 | (0.01) |
| Construction | 48 | 0.00 | (41,122.78) | (41,122.78) | 0.00 | (0.40) |
| Manufacturing | 66 | 0.00 | (74,573.61) | (74,573.61) | 0.00 | (0.48) |
| Transportation & Communication | 433 | 0.00 | (60,317.55) | (60,317.55) | 0.00 | (0.55) |
| Utilities | 443 | 0.00 | (44,687.19) | (44,687.19) | 0.00 | (0.12) |
| Trade | 447 | 0.00 | (334,553.53) | (334,553.53) | 0.00 | (5.72) |
| Eating & Drinking | 454 | 0.00 | (7,372.25) | (7,372.25) | 0.00 | (0.21) |
| Finance Insurance and Real Estate | 456 | 0.00 | (157,142.54) | (157,142.54) | 0.00 | (0.84) |
| Hotel Gaming and Recreation | 463 | 0.00 | (38,018.89) | (38,018.89) | 0.00 | (0.64) |
| Services | 464 | 0.00 | (144,749.32) | (144,749.32) | 0.00 | (2.67) |
| Health | 490 | 0.00 | (38,153.78) | (38,153.78) | 0.00 | (0.53) |
| Households | | 0.00 | (348,059.80) | (348,059.80) | 0.00 | 0.00 |

| | Direct Impacts | Indirect/Induced Impacts | Total Impacts |
|---|---|---|---|
| Total Industry Impacts | ($1,000,000.00) | ($971,077.84) | ($1,971,077.84) |
| Total Household Income Impact | | ($348,059.80) | ($348,059.80) |
| Total Employment Impacts | | | (32) |
| Total Economic Impacts | ($1,000,000.00) | ($1,319,137.64) | ($2,319,137.64) |
| Nevada Employment % | | | 92% |
| California Employment % | | | 8% |
| Change in County Expenditures - Nevada Counties | | | ($13,897) |
| Change in County Revenues - Nevada Counties | | | ($30,399) |
| Change in County Expenditures - California Counties | | | ($2) |
| Change in County Revenues - California Counties | | | ($2) |

**Table 14. Output Impacts Derived from UCED Impact Software.**

**Estimating Fiscal Impacts**

To calculate the fiscal impacts or changes in county revenues and expenses a number must be entered to tell the program where the employment is being gained and/or lost in the TROA/WQSA study area. Figure 6 shows the change employment option where the percentage of employment gained or lost from Nevada and California *needs* is entered for a calculation of fiscal impacts. Currently these cells are set to a default value of 92% Nevada employment and 8% California employment. Dividing the California employment by the total endogenous employment of the TROA/WQSA Study area (16,911 / 223,290) gives 8% of employment in California. The same was done with Nevada employment to arrive at 92% of the total employment in the study area. If the model operator knows no employment impacts should occur in California (or Nevada) due to the given impacts these cells should be changed to reflect no employment impacts or 0% for one state and 100% for the other.

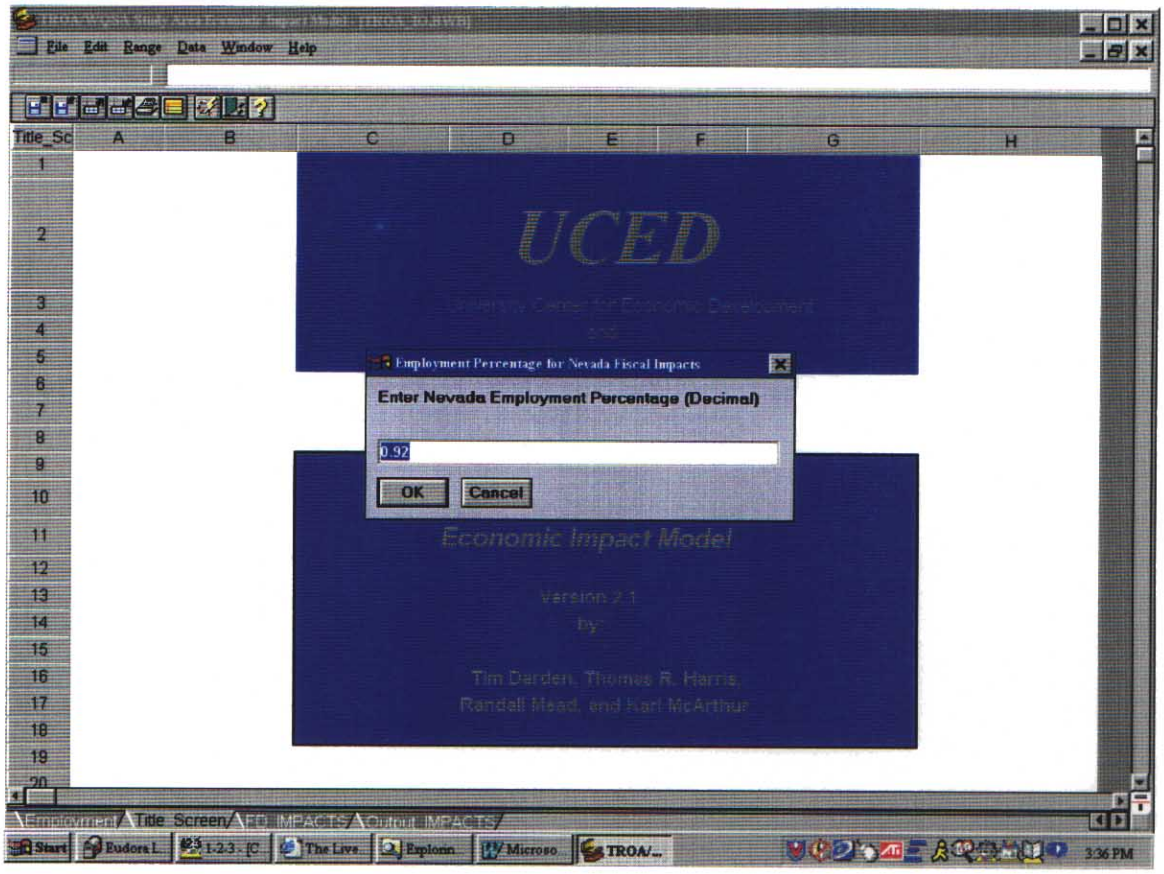



**Figure 6. TROA/WQSA Model Employment Percentage Calculation for Fiscal Analysis**

**Printing of Software Tables**

After final demand and output estimations have been calculated the software allows the user to print the tables by selecting the "Print FD" or "Print Output" option from the menu. Upon selecting one of these options the user will be asked to enter a title for the table as shown in Figure 7. This user may enter any text or not have any text at all by deleting the highlighted text in the title entry box. The table format will look just like tables 1 and 2 when printed.

**Help Directory**

A help directory has been included with the model to assist the user in operation and definition of terms used in the impact modeling software. The help directory consists of four sections. Section one lists definitions of the economic sectors used in the model. Section two shows the definitions of selected economic terms and functions used in the impact model. Section three provides a step by step guide to impact analysis using the TROA/WQSA Study Area Economic Impact Model. Lastly, section four provides a description and definition of the UCED Impact software menu items.

**Exiting the Program**

To exit the impact software program the user must first select "Quit" from the menu and strike enter on the keyboard or click "OK" with the mouse pointer. If any changes were made to the tables in the impact software the program will ask if you would like to save the file. The user can choose to save or not to save the program as entering zeros and recalculating the final demand impacts or output impacts will always reset the program.

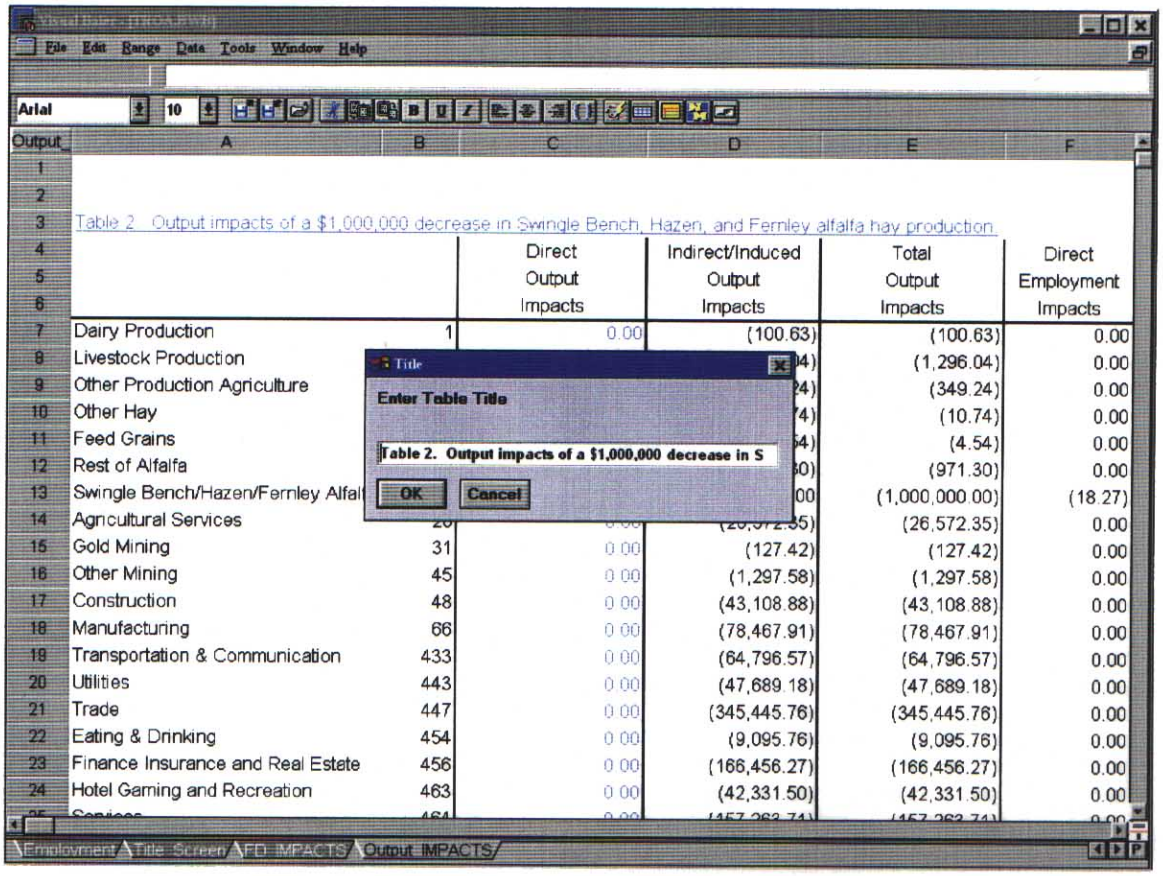



**Figure 7. Example Title for Analysis Table Printing**

# CONCLUSION

The economic impact model for the TROA/WQSA study area can be used to derive estimates of economic impacts from exogenous changes or "shocks" to the TROA/WQSA study area economy. Results of the analysis will provide information for the users of the model for the estimation of impacts and development of corresponding mitigation plans, as appropriate.

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# APPENDIX A:

## Mathematical Construction of Social Accounting Matrix Model

## Mathematical Construction of Social Accounting Matrix Model

(1). A common approach in input-output models is to use the fixed coefficients assumption. Under this assumption the elements in each column of the interindustry accounts are divided by the respective column total resulting in a table of technical coefficients. These coefficients are assumed to represent the production functions of the firms represented by each economic sector. By assuming that firms respond to changes in demand according to the parameters of the fixed-proportion function, a model can be specified as a system of simultaneous linear equations. The model can then be solved to yield coefficients through which changes in final demand are translated into changes in each sector's supply (20).

Similar assumptions are needed when creating a SAM model. Since the SAM model includes a more comprehensive view of the circular flow of income than a standard input-output model, it requires that the fixed coefficients assumption extends to the coefficients of all the endogenous accounts. The fixed coefficients assumption, which in interindustry input-output models is a fixed technology assumption, now must include the assumption that various household expenditure coefficients are fixed when household variables are treated as endogenous.

In input-output accounts only the interindustry linkages are formally specified. The linkage between household income and household spending is not defined nor is the linkage between government revenues and government spending or the linkage between savings and investment. The identification of these linkages in SAM accounts permits industry/household linkages to be specified with the same precision that interindustry linkages are specified in the input-output model. The result is that in SAM models, household, government, and investment variables may be more accurately treated as endogenous variables.

For purposes of this paper, only households are treated as endogenous. Our intent is to encourage a connection to a similar type of input-output model (Type II) with which many readers will be familiar. In order to construct a SAM model an assumption similar to the fixed coefficients assumption for the input-output model must be made. All of the normalized column coefficients for the endogenous accounts are assumed to be constant in the SAM model. The result is that in addition to the fixed technical coefficients of the input-output model, the distribution of nominal income between wages and profits must be assumed fixed, along with the

distribution of wage and profit income to household, average tax and savings rates of households and the sectoral composition of household consumption.

The result of treating households endogenous is a partitioned SAM:

$$S = \begin{bmatrix} A & O & C \\ V & O & O \\ O & Y & H \end{bmatrix}$$

Where: S = matrix of SAM coefficients

A = matrix of technical coefficients

V = matrix of value added (VA) coefficients

Y = matrix of VA distribution coefficients

C = matrix of expenditure coefficients

H = matrix of institutional and household distribution coefficients

The supply and demand balance equations can then be written as:

$$\begin{bmatrix} X \\ V \\ Y \end{bmatrix} = S \begin{bmatrix} X \\ V \\ Y \end{bmatrix} + \begin{bmatrix} ex \\ ev \\ ey \end{bmatrix}$$

Where: X = vector of sectoral supply

V = vector of value added by categories

y = vector of household incomes

ex = vector of exogenous commodity demand

ev = vector of exogenous value added

ey = vector of exogenous household incomes

The (I-S) matrix can then be inverted to specify a matrix equation that expresses levels of sectoral supply, value added, and household income as a function of exogenous variables. This yields:

$$\begin{bmatrix} X \\ V \\ Y \end{bmatrix} = (I - S)^{-1} \begin{bmatrix} ex \\ ev \\ ey \end{bmatrix}$$

Where $(I - S)^{-1}$ represents the matrix of SAM coefficients. Summing the columns of the $(I - S)^{-1}$ matrix derives the SAM multipliers for activities, value added, and households.

# APPENDIX B:

## County Level Control Total Data

## County Level Economic Data

As stated earlier the employment, output, and value-added figures for California counties were all derived based on the population of the county within the TROA/WQSA study area. The output and value- added figures were derived from the IMPLAN ratio of original employment to output and original employment to the value-added components. This coefficient was then multiplied by the derived employment from REIS and IMPLAN that was, as explained earlier, based on the percentage of population located within the study area. The following eight tables show the industry output, employment and value-added for each of the California and Nevada counties.

Alpine County, California

El Dorado County, California

Nevada County, California

Placer County, California

Sierra County, California

Churchill County, Nevada

Lyon County, Nevada

Washoe County, Nevada

**Table 15. Control Totals for Alpine County, California**

| | | Industry Output | Employment | Personal Income |
|---|---|---|---|---|
| 1 | Dairy Production | 0 | 0 | 0 |
| 3 | Livestock Production | 0 | 0 | 0 |
| 10 | Other Production Agriculture | 0 | 0 | 0 |
| 11 | Other Hay | 0 | 0 | 0 |
| 12 | Feed Grains | 0 | 0 | 0 |
| 13 | Rest of Alfalfa | 0 | 0 | 0 |
| 14 | Swingle Bench/Hazen/ Fernley Alfalfa | 0 | 0 | 0 |
| 26 | Agricultural Services | 0 | 0 | 0 |
| 31 | Gold Mining | 0 | 0 | 0 |
| 45 | Other Mining | 0 | 0 | 0 |
| 48 | Construction | 85,620 | 1 | 21,550 |
| 66 | Manufacturing | 0 | 0 | 0 |
| 433 | Transportation & Communication | 0 | 0 | 0 |
| 443 | Utilities | 0 | 0 | 0 |
| 447 | Trade | 0 | 0 | 0 |
| 454 | Eating & Drinking | 213,264 | 6 | 48,657 |
| 456 | Finance Insurance and Real Estate | 0 | 0 | 0 |
| 463 | Hotel Gaming and Recreation | 0 | 0 | 0 |
| 464 | Services | 55,735 | 1 | 16,866 |
| 490 | Health | 0 | 0 | 0 |
| 519 | Households | 0 | 0 | 0 |
| | Total: | 354,619 | 8 | 87,074 |

**Table 16. Control Totals for El Dorado County, California**

| | | Industry Output | Employment | Personal Income |
|---|---|---|---|---|
| 1 | Dairy Production | 0 | 0 | 0 |
| 3 | Livestock Production | 0 | 0 | 0 |
| 10 | Other Production Agriculture | 0 | 0 | 0 |
| 11 | Other Hay | 0 | 0 | 0 |
| 12 | Feed Grains | 0 | 0 | 0 |
| 13 | Rest of Alfalfa | 0 | 0 | 0 |
| 14 | Swingle Bench/Hazen/ Fernley Alfalfa | 0 | 0 | 0 |
| 26 | Agricultural Services | 2,939,715 | 106 | 1,346,287 |
| 31 | Gold Mining | 209,524 | 1 | 36,007 |
| 45 | Other Mining | 2,973,739 | 20 | 862,577 |
| 48 | Construction | 94,350,280 | 1,066 | 23,900,399 |
| 66 | Manufacturing | 63,655,683 | 505 | 12,715,951 |
| 433 | Transportation & Communication | 22,316,611 | 195 | 3,932,118 |
| 443 | Utilities | 24,996,651 | 72 | 8,044,749 |
| 447 | Trade | 81,969,090 | 1,652 | 26,753,929 |
| 454 | Eating & Drinking | 28,950,761 | 823 | 6,573,237 |
| 456 | Finance Insurance and Real Estate | 183,346,558 | 878 | 33,626,695 |
| 463 | Hotel Gaming and Recreation | 39,329,883 | 828 | 7,231,375 |
| 464 | Services | 82,024,528 | 1,663 | 23,681,857 |
| 490 | Health | 52,647,331 | 876 | 18,366,727 |
| 519 | Households | 0 | 0 | 0 |
| | Total: | 679,710,353 | 8,685 | 167,071,909 |

**Table 17. Control Totals for Nevada County, California**

| | | Industry Output | Employment | Personal Income |
|---|---|---|---|---|
| 1 | Dairy Production | 1,019,567 | 3 | 162,284 |
| 3 | Livestock Production | 1,798,675 | 8 | 108,785 |
| 10 | Other Production Agriculture | 4,319,906 | 40 | 1,401,711 |
| 11 | Other Hay | 0 | 0 | 0 |
| 12 | Feed Grains | 0 | 0 | 0 |
| 13 | Rest of Alfalfa | 133,638 | 1 | 7,035 |
| 14 | Swingle Bench/Hazen/ Fernley Alfalfa | 0 | 0 | 0 |
| 26 | Agricultural Services | 757,097 | 33 | 332,826 |
| 31 | Gold Mining | 230,652 | 1 | 43,460 |
| 45 | Other Mining | 1,381,476 | 12 | 373,212 |
| 48 | Construction | 36,483,964 | 442 | 9,107,054 |
| 66 | Manufacturing | 51,429,168 | 346 | 11,387,568 |
| 433 | Transportation & Communication | 7,819,126 | 78 | 1,595,939 |
| 443 | Utilities | 5,944,846 | 18 | 1,737,467 |
| 447 | Trade | 32,006,258 | 659 | 10,679,875 |
| 454 | Eating & Drinking | 7,630,547 | 232 | 1,619,370 |
| 456 | Finance Insurance and Real Estate | 55,884,469 | 313 | 14,694,389 |
| 463 | Hotel Gaming and Recreation | 6,431,236 | 175 | 1,213,325 |
| 464 | Services | 32,360,860 | 805 | 10,205,389 |
| 490 | Health | 22,697,212 | 374 | 7,716,632 |
| 519 | Households | 0 | 0 | 0 |
| | Total: | 268,328,696 | 3,540 | 72,386,321 |

**Table 18. Control Totals for Placer County, California**

| | | Industry Output | Employment | Personal Income |
|---|---|---|---|---|
| 1 | Dairy Production | 0 | 0 | 0 |
| 3 | Livestock Production | 0 | 0 | 0 |
| 10 | Other Production Agriculture | 0 | 0 | 0 |
| 11 | Other Hay | 0 | 0 | 0 |
| 12 | Feed Grains | 0 | 0 | 0 |
| 13 | Rest of Alfalfa | 0 | 0 | 0 |
| 14 | Swingle Bench/Hazen/ Fernley Alfalfa | 0 | 0 | 0 |
| 26 | Agricultural Services | 1,160,032 | 43 | 520,329 |
| 31 | Gold Mining | 439,312 | 2 | 81,203 |
| 45 | Other Mining | 829,699 | 5 | 134,879 |
| 48 | Construction | 52,766,968 | 601 | 13,481,899 |
| 66 | Manufacturing | 56,693,878 | 408 | 14,662,841 |
| 433 | Transportation & Communication | 32,047,513 | 206 | 6,948,132 |
| 443 | Utilities | 13,346,330 | 31 | 3,989,389 |
| 447 | Trade | 49,541,873 | 861 | 16,087,999 |
| 454 | Eating & Drinking | 13,839,805 | 391 | 3,160,953 |
| 456 | Finance Insurance and Real Estate | 78,598,999 | 409 | 19,714,491 |
| 463 | Hotel Gaming and Recreation | 14,214,660 | 324 | 2,758,881 |
| 464 | Services | 35,616,728 | 848 | 11,308,435 |
| 490 | Health | 24,784,417 | 391 | 8,535,972 |
| 519 | Households | 0 | 0 | 0 |
| | Total: | 373,880,214 | 4,520 | 101,385,404 |

**Table 19. Control Totals for Sierra County California**

| | Industry Output | Employment | Personal Income |
|---|---|---|---|
| 1 Dairy Production | 0 | 0 | 0 |
| 3 Livestock Production | 0 | 0 | 0 |
| 10 Other Production Agriculture | 0 | 0 | 0 |
| 11 Other Hay | 0 | 0 | 0 |
| 12 Feed Grains | 0 | 0 | 0 |
| 13 Rest of Alfalfa | 0 | 0 | 0 |
| 14 Swingle Bench/Hazen/ Fernley Alfalfa | 0 | 0 | 0 |
| 26 Agricultural Services | 67,917 | 3 | 29,967 |
| 31 Gold Mining | 2,285,143 | 11 | 391,276 |
| 45 Other Mining | 57,476 | 1 | 13,983 |
| 48 Construction | 1,370,105 | 19 | 343,954 |
| 66 Manufacturing | 6,312,447 | 39 | 1,182,815 |
| 433 Transportation & Communication | 237,828 | 5 | 52,375 |
| 443 Utilities | 0 | 0 | 0 |
| 447 Trade | 1,066,675 | 30 | 346,300 |
| 454 Eating & Drinking | 223,889 | 7 | 45,804 |
| 456 Finance Insurance and Real Estate | 1,538,618 | 8 | 323,516 |
| 463 Hotel Gaming and Recreation | 434,608 | 12 | 69,558 |
| 464 Services | 697,434 | 19 | 194,919 |
| 490 Health | 219,971 | 4 | 70,035 |
| 519 Households | 0 | 0 | 0 |
| Total: | 14,512,109 | 158 | 3,064,503 |

**Table 20. Control Totals for Churchill County, Nevada**

| | | Industry Output | Employment | Personal Income |
|---|---|---|---|---|
| 1 | Dairy Production | 18,855,788 | 136 | 3,854,092 |
| 3 | Livestock Production | 11,008,802 | 106 | 1,046,345 |
| 10 | Other Production Agriculture | 9,492,366 | 35 | 2,311,020 |
| 11 | Other Hay | 1,069,800 | 12 | 67,888 |
| 12 | Feed Grains | 288,316 | 5 | 76,608 |
| 13 | Rest of Alfalfa | 11,791,600 | 267 | 2,271,617 |
| 14 | Swingle Bench/Hazen/Fernley Alfalfa | 635,800 | 12 | 39,692 |
| 26 | Agricultural Services | 3,148,256 | 180 | 1,369,186 |
| 31 | Gold Mining | 7,498,427 | 31 | 1,262,337 |
| 45 | Other Mining | 3,336,759 | 46 | 1,058,524 |
| 48 | Construction | 65,191,944 | 689 | 15,106,875 |
| 66 | Manufacturing | 83,618,783 | 406 | 11,838,545 |
| 433 | Transportation & Communication | 22,310,598 | 242 | 5,923,015 |
| 443 | Utilities | 33,616,000 | 88 | 11,237,161 |
| 447 | Trade | 61,646,062 | 1,289 | 19,069,362 |
| 454 | Eating & Drinking | 19,380,987 | 602 | 4,085,047 |
| 456 | Finance Insurance and Real Estate | 81,918,743 | 533 | 20,283,204 |
| 463 | Hotel Gaming and Recreation | 34,305,086 | 598 | 5,634,267 |
| 464 | Services | 97,232,673 | 1,975 | 34,225,058 |
| 490 | Health | 31,652,092 | 916 | 8,029,208 |
| 519 | Households | 0 | 0 | 0 |
| | Total: | 597,998,884 | 8,168 | 148,789,051 |

**Table 21. Control Totals for Lyon County, Nevada**

| | | Industry Output | Employment | Personal Income |
|---|---|---|---|---|
| 1 | Dairy Production | 5,048,363 | 23 | 618,770 |
| 3 | Livestock Production | 11,199,613 | 127 | 1,670,795 |
| 10 | Other Production Agriculture | 10,872,147 | 73 | 3,473,516 |
| 11 | Other Hay | 950,400 | 10 | 55,264 |
| 12 | Feed Grains | 236,215 | 4 | 61,287 |
| 13 | Rest of Alfalfa | 15,882,160 | 219 | 3,059,651 |
| 14 | Swingle Bench/Hazen/Fernley Alfalfa | 1,389,240 | 25 | 86,728 |
| 26 | Agricultural Services | 2,385,375 | 221 | 1,072,166 |
| 31 | Gold Mining | 14,278,293 | 63 | 2,162,338 |
| 45 | Other Mining | 18,567,972 | 159 | 4,575,664 |
| 48 | Construction | 83,756,256 | 878 | 19,013,445 |
| 66 | Manufacturing | 253,400,329 | 1,721 | 39,840,802 |
| 433 | Transportation & Communication | 25,609,479 | 290 | 7,443,325 |
| 443 | Utilities | 34,817,999 | 117 | 11,856,972 |
| 447 | Trade | 63,923,731 | 1,341 | 19,098,953 |
| 454 | Eating & Drinking | 12,551,984 | 401 | 2,560,598 |
| 456 | Finance Insurance and Real Estate | 98,116,517 | 466 | 17,290,814 |
| 463 | Hotel Gaming and Recreation | 27,428,749 | 514 | 4,501,916 |
| 464 | Services | 76,188,971 | 1,702 | 22,812,432 |
| 490 | Health | 17,546,088 | 411 | 4,717,619 |
| 519 | Households | 0 | 0 | 0 |
| | Total: | 774,149,883 | 8,765 | 165,973,053 |

**Table 22. Control Totals for Washoe County, Nevada**

| | | Industry Output | Employment | Personal Income |
|---|---|---|---|---|
| 1 | Dairy Production | 1,512,922 | 5 | 186,540 |
| 3 | Livestock Production | 7,161,586 | 177 | 1,702,404 |
| 10 | Other Production Agriculture | 6,899,301 | 40 | 3,151,953 |
| 11 | Other Hay | 510,860 | 6 | 45,237 |
| 12 | Feed Grains | 111,479 | 2 | 30,643 |
| 13 | Rest of Alfalfa | 4,389,600 | 137 | 845,643 |
| 14 | Swingle Bench/Hazen/Fernley Alfalfa | 0 | 0 | 0 |
| 26 | Agricultural Services | 38,310,452 | 1,698 | 17,530,043 |
| 31 | Gold Mining | 181,374,645 | 648 | 39,101,213 |
| 45 | Other Mining | 49,240,630 | 359 | 19,163,864 |
| 48 | Construction | 1,416,661,958 | 13,449 | 357,409,288 |
| 66 | Manufacturing | 2,064,927,699 | 13,276 | 370,988,599 |
| 433 | Transportation & Communication | 1,178,026,134 | 10,715 | 319,503,530 |
| 443 | Utilities | 543,968,337 | 1,420 | 183,785,556 |
| 447 | Trade | 2,049,980,561 | 34,151 | 632,055,817 |
| 454 | Eating & Drinking | 338,048,045 | 9,447 | 78,983,817 |
| 456 | Finance Insurance and Real Estate | 2,522,506,929 | 13,511 | 800,881,382 |
| 463 | Hotel Gaming and Recreation | 2,239,171,144 | 37,215 | 359,501,658 |
| 464 | Services | 1,907,776,962 | 34,168 | 605,021,868 |
| 490 | Health | 967,071,304 | 12,405 | 345,570,130 |
| 519 | Households | 0 | 0 | 0 |
| | Total: | 15,517,650,549 | 182,829 | 4,135,459,185 |

## Population

Population for California counties was estimated using the ARCINFO geographical information system package. The area included in the TROA/WQSA study area was mapped out using the software and the Census tract included or deleted based on their proximity to the study area. For the California counties it was determined that the population percentages were: Alpine 1%, El Dorado 20%, Nevada 11%, Placer 5%, and Sierra 16%. The population totals for areas in both states came from the 1990 Census of Population (29) and are shown in Table 23.

**Table 23. Population for the TROA/WQSA Study Area by County and by State**

| County | California Population in the Region all persons | Nevada Population in the Region all persons | Total Population in the Region all persons | Percentage of Population |
|---|---|---|---|---|
| Sierra | 531 | | 531 | 0.16% |
| Nevada | 8,636 | | 8,636 | 2.57% |
| Placer | 8,640 | | 8,640 | 2.57% |
| El Dorado | 25,199 | | 25,199 | 7.51% |
| Alpine | 11 | | 11 | 0.00% |
| Washoe | | 254,667 | 254,667 | 75.88% |
| Lyon | | 20,001 | 20,001 | 5.96% |
| Churchill | | 17,938 | 17,938 | 5.34% |
| Total | 43,017 | 292,606 | 335,623 | 100.00% |
| Percentage of Population | 12.82% | 87.18% | 100.00% | |

## Housing

The amount of housing in the TROA/WQSA study area was developed using many pieces of data from the 1990 Census of Housing. To arrive at housing by economic sector, four different data sets were needed. Those data sets included population from Table 4, housing units, occupied housing units, and household types. Multiplying the percentage of TROA/WQSA study area population within a study area county by housing unit statistics produced the information in Table 24. Then a ratio of each housing unit to total housing units was multiplied by occupied housing units to arrive at a total of occupied housing for the study area (Table 25). Finally figures from occupied housing were multiplied by family and non-family household statistics to arrive at a ratio of population to households (Table 26). These ratios were then multiplied by the figures in Table 4 to arrive at the housing calculations in Table 5.

## Commercial Water Use

Commercial water use per employee was assumed to have not changed since the original Truckee River Basin model was constructed (18).

## Residential Water Use

Residential water use per household was assumed to have not changed since the original Truckee River Basin Model was constructed (18).

**Table 24. Housing Units by Type for the TROA/WQSA Study Area by County for California**

| California | Sierra County dwellings | Nevada County dwellings | Placer County dwellings | El Dorado County dwellings | Alpine County dwellings | Total dwellings |
|---|---|---|---|---|---|---|
| Single Units | 279 | 3,666 | 3,072 | 9,660 | 9 | 16,686 |
| Multi-Units of Less than Ten per Structure | 62 | 690 | 627 | 2,163 | 4 | 3,546 |
| Multi-Units of Ten or More per Structure | 6 | 125 | 195 | 467 | 1 | 793 |
| **Total** | 347 | 4,481 | 3,894 | 12,290 | 13 | 21,025 |

| Nevada | Washoe County dwellings | Lyon County dwellings | Churchill County dwellings | Total dwellings |
|---|---|---|---|---|
| Single Units | 59,687 | 4,666 | 6,106 | 70,459 |
| Multi-Units of Less than Ten per Structure | 33,658 | 4,038 | 957 | 38,653 |
| Multi-Units of Ten or More per Structure | 18,848 | 17 | 227 | 19,093 |
| **Total** | 112,193 | 8,722 | 7,290 | 128,205 |

**Table 24. Continued**

| | California | Nevada | Total |
|---|---|---|---|
| Housing Units | 21,025 | 128,205 | 149,230 |
| Population as All Persons | 43,017 | 292,606 | 335,623 |
| Ratio of Housing Units to Population | 0.48875530 | 0.43814891 | 0.44463516 |

**Table 25. Occupied Housing Units by Type for the TROA/WQSA Study Area by County for California**

| California | Sierra County dwellings | Nevada County dwellings | Placer County dwellings | El Dorado County dwellings | Alpine County dwellings | Total dwellings |
|---|---|---|---|---|---|---|
| Single Units | 172 | 2,768 | 2,529 | 7,364 | 3 | 12,835 |
| Multi-Units of Less than Ten per Structure | 38 | 521 | 516 | 1,649 | 1 | 2,726 |
| Multi-Units of Ten or More per Structure | 3 | 94 | 160 | 356 | 0 | 614 |
| **Total** | 214 | 3,383 | 3,205 | 9,369 | 4 | 16,175 |

| Nevada | Washoe County dwellings | Lyon County dwellings | Churchill County dwellings | Total dwellings |
|---|---|---|---|---|
| Single Units | 54,420 | 4,109 | 13,313 | 71,843 |
| Multi-Units of Less than Ten per Structure | 30,688 | 3,556 | 2,087 | 36,331 |
| Multi-Units of Ten or More per Structure | 17,185 | 15 | 495 | 17,696 |
| **Total** | 102,294 | 7,680 | 15,895 | 125,869 |

**Table 25. Continued**

| | California | Nevada | Total |
|---|---|---|---|
| Occupied Housing Units | 16,175 | 125,869 | 142,044 |
| Population as All Persons | 43,017 | 292,606 | 335,623 |
| Ratio of Occupied Housing Units to Population | 0.37601965 | 0.43016548 | 0.42322558 |

**Table 26. Households by Type for the TROA/WQSA Study Area by County for Califronia.**

| California | Sierra County households | Nevada County households | Placer County households | El Dorado County households | Alpine County households | Total households |
|---|---|---|---|---|---|---|
| Family Households | 149 | 2,516 | 2,388 | 6,998 | 3 | 12,053 |
| Non-Family Households | 65 | 867 | 818 | 2,371 | 1 | 4,122 |
| Total | 214 | 3,383 | 3,205 | 9,369 | 4 | 16,175 |

| Nevada | Washoe County households | Lyon County households | Churchill County households | Total households |
|---|---|---|---|---|
| Family Households | 74,613 | 5,629 | 10,618 | 90,861 |
| Non-Family Households | 27,681 | 2,051 | 5,277 | 35,008 |
| Total | 102,294 | 7,680 | 15,895 | 125,869 |

**Table 26. Continued**

| | California | Nevada | Total |
|---|---|---|---|
| Households | 16,175 | 125,869 | 142,044 |
| Population as All Persons | 43,017 | 292,606 | 335,623 |
| Ratio of Households to Population | 0.37601962 | 0.43016548 | 0.42322557 |

# APPENDIX C:

## Updates to the Original Truckee River Basin Regional Economic Impact Model

## TROA/WQSA Recreational Impact Model

In updating the Truckee River Basin Economic Impact Model, social accounts were added to illustrate the distribution of income throughout the economy. With this change a new set of output requirements were produced to include the added regions and the social accounts. These will be displayed at the end of the water transfer model.

### Recreational Use

The number of recreational visitors to Donner Lake, Prosser Reservoir, Stampede Reservoir, and Boca Reservoir were updated to reflect visitor totals for 1997. The updated figures were obtained through conversation with the personnel at Tahoe National Forest and Donner Lake State Park and are shown in Table 27.

**Table 27. Annual Number of Camping Visitors by Campground by Reservoir.**

| | Donner Lake | Prosser Reservoir | Stampede Reservoir | Boca Reservoir |
|---|---|---|---|---|
| Camping Visitors for Donner State Park | 46,161 | | | |
| Camping Visitors for Lakeside Campground | | 16,288 | | |
| Camping Visitors for Prosser Family Campground | | 4,282 | | |
| Camping Visitors for Prosser Ranch Campground | | 34,793 | | |
| Camping Visitors for Annie McCloud Campground | | 0 | | |
| Camping Visitors for Davies Creek Campground | | | 2,863 | |
| Camping Visitors for Emigrant Campground | | | 94,837 | |
| Camping Visitors for Logger Campground | | | 108,412 | |
| Camping Visitors for Boca Campground | | | | 11,550 |
| Camping Visitors for Boca Rest Campground | | | | 20,974 |
| Camping Visitors for Boca Spring Campground | | | | 4,272 |
| Camping Visitors for Boyington Mill Campground | | | | 4,867 |
| Total Number of Camping Visitors for Campgrounds | 46,161 | 55,363 | 206,112 | 41,663 |

Note: There are 152 open campsites at Donner Lake; 46 open campsites at Prosser Reservoir; 216 to 256 open campsites at Stampede Reservoir; and 59 open campsites at Boca Reservoir

**Camping Visitor Expenditures**

The camping and visitor expenditures were updated to reflect 1995 values using the Consumer Price Index. The estimated increase in consumer prices over that time period was 1.035. All expenditure data was multiplied by this figure to arrive at 1995 expenditure values. Tables 28 through 33 show the adjusted recreational visitor expenditures.

**Table 28. Camping Visitor Group Expenditures Function Values by Reservoir**

| | Donner Lake | Prosser Reservoir | Stampede Reservoir | Boca Reservoir |
|---|---|---|---|---|
| Camping Visitor Group Expenditure per Day | $38.26 | $28.88 | $41.00 | $35.60 |

Note: Consumer Price Index 1993-1995 average was 1.035

**Table 29. Annual Camping Visitor Expenditures by Category by Reservoir**

| | Donner Lake | Prosser Reservoir | Stampede Reservoir | Boca Reservoir |
|---|---|---|---|---|
| Camping Visitor Expenditures during April | 16,605 | 23,168 | 79,992 | 17,899 |
| Camping Visitor Expenditures during May | 29,059 | 43,440 | 172,614 | 39,527 |
| Camping Visitor Expenditures during June | 58,948 | 75,295 | 362,069 | 51,459 |
| Camping Visitor Expenditures during July | 85,516 | 101,359 | 349,438 | 55,934 |
| Camping Visitor Expenditures during August | 79,704 | 95,567 | 408,380 | 58,171 |
| Camping Visitor Expenditures during September | 36,531 | 49,231 | 181,034 | 38,035 |
| Camping Visitor Expenditures during October | 13,284 | 31,856 | 88,412 | 21,628 |
| Camping Visitor Expenditures during Other Months | 17,435 | 8,688 | 8,420 | 8,204 |
| Annual Camping Visitors Expenditures | $337,081 | $428,603 | $1,650,359 | $290,857 |

**Table 30. Annual Camping Visitor Expenditures by Category by Reservoir.**

| | Donner Lake | Prosser Reservoir | Stampede Reservoir | Boca Reservoir |
|---|---|---|---|---|
| Number of Camping Respondents | 42 | 30 | 97 | 21 |
| Expenditures on Licenses by Camping Respondents | 0.00 | 0.00 | 552.63 | 72.04 |
| Expenditures on Camping Fees by Camping Respondents | 2117.42 | 644.91 | 4379.28 | 449.20 |
| Expenditures on Hotel or Motel by Camping Respondents | 243.43 | 0.00 | 0.00 | 227.68 |
| Expenditures on Restaurant by Camping Respondents | 1231.51 | 255.54 | 1119.06 | 124.22 |
| Expenditures on Groceries by Camping Respondents | 2476.05 | 1905.23 | 6078.50 | 2101.08 |
| Expenditures on Equipment and Supplies by Camping Respondents | 0.00 | 0.00 | 515.06 | 1.66 |
| Expenditures on Rental by Camping Respondents | 26.08 | 0.00 | 0.00 | 3.17 |
| Expenditures on Fuel by Camping Respondents | 677.26 | 378.50 | 2760.32 | 454.76 |
| Expenditures on Other by Camping Respondents | 1102.40 | 433.15 | 3898.22 | 712.13 |
| Total Expenditures by Camping Respondents | $7,874.16 | $3,617.33 | $19,303.08 | $4,145.93 |

**Table 30. Continued**

| | Donner Lake | Prosser Reservoir | Stampede Reservoir | Boca Reservoir |
|---|---|---|---|---|
| Expenditures on Licenses by Camping Respondents | 0.00% | 0.00% | 2.86% | 1.74% |
| Expenditures on Camping Fees by Camping Respondents | 26.89% | 17.83% | 22.69% | 10.83% |
| Expenditures on Hotel or Motel by Camping Respondents | 3.09% | 0.00% | 0.00% | 5.49% |
| Expenditures on Restaurant by Camping Respondents | 15.64% | 7.06% | 5.80% | 3.00% |
| Expenditures on Groceries by Camping Respondents | 31.45% | 52.67% | 31.49% | 50.68% |
| Expenditures on Equipment and Supplies by Camping Respondents | 0.00% | 0.00% | 2.67% | 0.04% |
| Expenditures on Rental by Camping Respondents | 0.33% | 0.00% | 0.00% | 0.08% |
| Expenditures on Fuel by Camping Respondents | 8.60% | 10.46% | 14.30% | 10.97% |
| Expenditures on Other by Camping Respondents | 14.00% | 11.97% | 20.19% | 17.18% |
| Total Expenditures by Camping Respondents | 100.00% | 100.00% | 100.00% | 100.00% |

**Table 30. Continued**

| | Donner Lake | Prosser Reservoir | Stampede Reservoir | Boca Reservoir |
|---|---|---|---|---|
| Annual Camping Visitor Expenditures on Licenses | 0 | 0 | 47,248 | 5,054 |
| Annual Camping Visitor Expenditures on Camping Fees | 90,644 | 76,413 | 374,416 | 31,514 |
| Annual Camping Visitor Expenditures on Hotel or Motel | 10,421 | 0 | 0 | 15,973 |
| Annual Camping Visitor Expenditures on Restaurant | 52,719 | 30,278 | 95,677 | 8,715 |
| Annual Camping Visitor Expenditures on Groceries | 105,996 | 225,743 | 519,695 | 147,401 |
| Annual Camping Visitor Expenditures on Equipment and Supplies | 0 | 0 | 44,036 | 116 |
| Annual Camping Visitor Expenditures on Rental | 1,117 | 0 | 0 | 222 |
| Annual Camping Visitor Expenditures on Fuel | 28,993 | 44,847 | 236,000 | 31,903 |
| Annual Camping Visitor Expenditures on Other | 47,192 | 51,322 | 333,287 | 49,959 |
| Annual Camping Visitor Expenditures | $337,081 | $428,603 | $1,650,359 | $290,857 |

**Table 31. Day Use Visitor Group Expenditures Function Values by Reservoir**

| | Donner Lake | Prosser Reservoir | Stampede Reservoir | Boca Reservoir |
|---|---|---|---|---|
| Day Use Visitor Group Expenditure per Day | $53.82 | $35.26 | $54.63 | $50.56 |

Note: Consumer Price Index 1990-1995 was 1.035

**Table 32. Annual Day Use Visitor Expenditures by Month by Reservoir**

| | Donner Lake | Prosser Reservoir | Stampede Reservoir | Boca Reservoir |
|---|---|---|---|---|
| Day Use Visitor Expenditures during April | 90,715 | 12,824 | 27,531 | 32,543 |
| Day Use Visitor Expenditures during May | 158,752 | 24,045 | 59,408 | 71,865 |
| Day Use Visitor Expenditures during June | 322,039 | 41,678 | 124,612 | 93,561 |
| Day Use Visitor Expenditures during July | 467,183 | 56,105 | 120,265 | 101,696 |
| Day Use Visitor Expenditures during August | 435,433 | 52,899 | 140,551 | 105,764 |
| Day Use Visitor Expenditures during September | 199,573 | 27,251 | 62,306 | 69,154 |
| Day Use Visitor Expenditures during October | 72,572 | 17,633 | 30,429 | 39,323 |
| Day Use Visitor Expenditures during Other Months | 95,251 | 4,809 | 2,898 | 14,915 |
| Annual Day Use Visitor Expenditures | $1,841,518 | $237,245 | $567,999 | $528,821 |

**Table 33. Annual Day Use Visitor Expenditures by Category by Reservoir**

| | Donner Lake | Prosser Reservoir | Stampede Reservoir | Boca Reservoir |
|---|---|---|---|---|
| Number of Day Use Respondents | 71 | 8 | 9 | 54 |
| Expenditures on Licenses by Day Use Respondents | 0.00 | 147.36 | 359.56 | 389.16 |
| Expenditures on Camping Fees by Day Use Respondents | 171.44 | 0.00 | 0.00 | 303.05 |
| Expenditures on Hotel or Motel by Day Use Respondents[1] | 1139.55 | 6.21 | 149.04 | 1363.24 |
| Expenditures on Restaurant by Day Use Respondents | 1210.49 | 258.77 | 139.73 | 555.96 |
| Expenditures on Groceries by Day Use Respondents | 1563.23 | 258.77 | 208.66 | 1457.86 |
| Expenditures on Equipment and Supplies by Day Use Respondents | 363.60 | 27.95 | 35.02 | 238.46 |
| Expenditures on Rental by Day Use Respondents | 989.85 | 1009.13 | 0.00 | 0.00 |
| Expenditures on Fuel by Day Use Respondents | 464.74 | 124.18 | 188.16 | 917.22 |
| Expenditures on Other by Day Use Respondents | 334.46 | 51.75 | 13.97 | 303.05 |
| Total Expenditures by Day Use Respondents | $6,237.36 | $1,884.11 | $1,094.14 | $5,528.00 |

**Table 33. Continued**

| | Donner Lake | Prosser Reservoir | Stampede Reservoir | Boca Reservoir |
|---|---|---|---|---|
| Expenditures on Licenses by Day Use Respondents | 0.00% | 7.82% | 32.86% | 7.04% |
| Expenditures on Camping Fees by Day Use Respondents | 2.75% | 0.00% | 0.00% | 5.48% |
| Expenditures on Hotel or Motel by Day Use Respondents /1 | 18.27% | 0.33% | 13.62% | 24.66% |
| Expenditures on Restaurant by Day Use Respondents | 19.41% | 13.73% | 12.77% | 10.06% |
| Expenditures on Groceries by Day Use Respondents | 25.06% | 13.73% | 19.07% | 26.37% |
| Expenditures on Equipment and Supplies by Day Use Respondents | 5.83% | 1.48% | 3.20% | 4.31% |
| Expenditures on Rental by Day Use Respondents | 15.87% | 53.56% | 0.00% | 0.00% |
| Expenditures on Fuel by Day Use Respondents | 7.45% | 6.59% | 17.20% | 16.59% |
| Expenditures on Other by Day Use Respondents | 5.36% | 2.75% | 1.28% | 5.48% |
| Total Expenditures by Day Use Respondents | 100.00% | 100.00% | 100.00% | 100.00% |

**Table 33. Continued**

| | Donner Lake | Prosser Reservoir | Stampede Reservoir | Boca Reservoir |
|---|---|---|---|---|
| Annual Day Use Visitor Expenditures on Licenses | 0 | 18,556 | 186,657 | 37,228 |
| Annual Day Use Visitor Expenditures on Camping Fees | 50,615 | 0 | 0 | 28,990 |
| Annual Day Use Visitor Expenditures on Hotel or Motel* | 336,440 | 782 | 77,371 | 130,411 |
| Annual Day Use Visitor Expenditures on Restaurant | 357,387 | 32,584 | 72,535 | 53,184 |
| Annual Day Use Visitor Expenditures on Groceries | 461,529 | 32,584 | 108,319 | 139,462 |
| Annual Day Use Visitor Expenditures on Equipment and Supplies | 107,348 | 3,519 | 18,182 | 22,812 |
| Annual Day Use Visitor Expenditures on Rental | 292,244 | 127,068 | 0 | 0 |
| Annual Day Use Visitor Expenditures on Fuel | 137,209 | 15,636 | 97,681 | 87,743 |
| Annual Day Use Visitor Expenditures on Other | 98,746 | 6,516 | 7,254 | 28,990 |
| Total Annual Day Use Visitor Expenditures | $1,841,518 | $237,245 | $567,999 | $528,821 |

*Expenditures on hotel or motel include vacation-home rent expenditures

## TROA/WQSA Water Transfer Impact Model

In updating the Truckee River Basin Water Transfer Economic Impact Model, social accounts were added to illustrate the distribution of income throughout the economy. With this change a new set of output requirements were produced to include the added regions and the social accounts.

### Water Transfer Coefficients

Due to the changes in model sectors (i.e. the addition of the Swingle Bench, Hazen, and Fernley Alfalfa Sector) new water transfer coefficients were calculated. These water transfer coefficients reflect the increase in agricultural water use and non-agricultural use in the region due to the restructuring of the model. Table 34 shows the changes in water transfer coefficients.

## Table 34. Water Transfer Coefficients by Economic Sector for the Region

| | | Agriculture Water Use acre-feet | Adjusted[1] Agriculture Water Use acre-feet | Agriculture Water Transfer Coefficient | Commercial Water Use acre-feet | Adjusted[2] Commercial Water Use acre-feet | Commercial Water Transfer Coefficient |
|---|---|---|---|---|---|---|---|
| 1 | Dairy Production | 93,832 | 0 | 0.00000000 | 8 | 0 | 0.00000000 |
| 2 | Livestock Production | 67,533 | 67,533 | 1.00000000 | 20 | 0 | 0.00000000 |
| 3 | Other Production Agriculture | 13,616 | 0 | 0.00000000 | 9 | 0 | 0.00000000 |
| 4 | Other Hay | 355 | 0 | 0.00000000 | 1 | 0 | 0.00000000 |
| 5 | Feed Grains | 13,616 | 0 | 0.00000000 | 1 | 0 | 0.00000000 |
| 6 | Rest of Alfalfa | 295,717 | 0 | 0.00000000 | 30 | 0 | 0.00000000 |
| 7 | Swingle Bench/Hazen/ Fernley Alfalfa | 26,802 | 0 | 0.00000000 | 2 | 0 | 0.00000000 |
| 8 | Agricultural Services | 0 | 0 | 0.00000000 | 109 | 0 | 0.00000000 |
| 9 | Gold Mining | 0 | 0 | 0.00000000 | 8 | 0 | 0.00000000 |
| 10 | Other Mining | 0 | 0 | 0.00000000 | 7 | 0 | 0.00000000 |
| 11 | Construction | 0 | 0 | 0.00000000 | 327 | 0 | 0.00000000 |
| 12 | Manufacturing | 0 | 0 | 0.00000000 | 671 | 671 | 0.08637400 |
| 13 | Transportation and Communications | 0 | 0 | 0.00000000 | 376 | 0 | 0.00000000 |
| 14 | Utilities | 0 | 0 | 0.00000000 | 399 | 0 | 0.00000000 |
| 15 | Trade | 0 | 0 | 0.00000000 | 1,481 | 0 | 0.00000000 |
| 16 | Eating, Drinking | 0 | 0 | 0.00000000 | 1,283 | 0 | 0.00000000 |
| 17 | Finance, Insurance, and Real Estate | 0 | 0 | 0.00000000 | 352 | 0 | 0.00000000 |
| 18 | Hotels, Gaming, and Recreation | 0 | 0 | 0.00000000 | 7,098 | 7,098 | 0.91362600 |
| 19 | Services | 0 | 0 | 0.00000000 | 2,314 | 0 | 0.00000000 |
| 20 | Health | 0 | 0 | 0.00000000 | 1,294 | 0 | 0.00000000 |
| | Total | 511,470 | 67,533 | 1.00000000 | 15,790 | 7,769 | 1.00000000 |

[1]Adjusted agriculture water use reflects assignment of only the livestock production sector.

[2]Adjusted commercial water use reflects assignment of only the manufacturing sector, the transportation and communications sector (i.e. warehousing industry) and the hotel, gaming and recreation sector (i.e. casino gaming industry)

**Output Requirements**

The output requirements are the basis for the Input-Output model framework. These figures make up the multipliers used to estimate impacts in all of the models. Table 35 shows the new output requirements (output multipliers) used for the TROA/WQSA Economic Impact Models.

**Table 35. Output Requirements**

| | | 1<br>Dairy Production | 2<br>Livestock Production | 3<br>Other Production Agriculture | 4<br>Other Hay | 5<br>Feed Grains | 6<br>Rest of Alfalfa |
|---|---|---|---|---|---|---|---|
| | Economic Sector | $ | $ | $ | $ | $ | $ |
| 1 | Dairy Production | 1.00000000 | 0.00044877 | 0.00012263 | 0.00011221 | 0.00009257 | 0.00016488 |
| 2 | Livestock Production | 0.00091216 | 1.00000000 | 0.00175074 | 0.00154673 | 0.00115235 | 0.00180956 |
| 3 | Other Production Agriculture | 0.00033318 | 0.00125598 | 1.00000000 | 0.00034019 | 0.00041583 | 0.00080495 |
| 4 | Other Hay | 0.00000930 | 0.00025377 | 0.00001715 | 1.00000000 | 0.00001144 | 0.00002224 |
| 5 | Feed Grains | 0.00038101 | 0.00001814 | 0.00000667 | 0.00000461 | 1.00000000 | 0.00008308 |
| 6 | Rest of Alfalfa | 0.00205707 | 0.00283296 | 0.00122436 | 0.00070916 | 0.00100456 | 1.00000000 |
| 7 | Swingle Bench /Hazen/Fernley Alfalfa | 0.00003956 | 0.00000157 | 0.00000066 | 0.00000094 | 0.00002525 | 0.00000644 |
| 8 | Agricultural Services | 0.02562534 | 0.10246398 | 0.04717403 | 0.02631955 | 0.03056989 | 0.06190820 |
| 9 | Gold Mining | 0.00008796 | 0.00013064 | 0.00008812 | 0.00021983 | 0.00011697 | 0.00017124 |
| 10 | Other Mining | 0.00099769 | 0.00151042 | 0.00090859 | 0.00243542 | 0.00128384 | 0.00189244 |
| 11 | Construction | 0.02918357 | 0.06139095 | 0.02413848 | 0.04535836 | 0.02387253 | 0.03392562 |
| 12 | Manufacturing | 0.03461563 | 0.04496538 | 0.05338070 | 0.09748070 | 0.05459230 | 0.07700188 |
| 13 | Transportation & Communication | 0.05533050 | 0.04694351 | 0.03680528 | 0.06542188 | 0.03925219 | 0.04994531 |
| 14 | Utilities | 0.04423789 | 0.06970457 | 0.02953213 | 0.03946291 | 0.02768283 | 0.03907301 |
| 15 | Trade | 0.32050299 | 0.22275596 | 0.10309043 | 0.17849736 | 0.13797369 | 0.15537704 |
| 16 | Eating & Drinking | 0.00921490 | 0.00834300 | 0.00996229 | 0.00594323 | 0.00873594 | 0.00831201 |
| 17 | Finance Insurance and Real Estate | 0.15441284 | 0.09538352 | 0.10590095 | 0.12741626 | 0.11762456 | 0.14141973 |
| 18 | Hotel Gaming and Recreation | 0.04138796 | 0.03229899 | 0.02752695 | 0.02533002 | 0.02712752 | 0.02803095 |
| 19 | Services | 0.11374710 | 0.10809757 | 0.08686204 | 0.08874150 | 0.07834320 | 0.09244831 |
| 20 | Health | 0.05202836 | 0.05276338 | 0.05414753 | 0.03023131 | 0.04770219 | 0.04464605 |
| 21 | Households | 0.44704118 | 0.41049215 | 0.50205881 | 0.27721312 | 0.44148262 | 0.41230441 |
| | Column Total | 2.33214620 | 2.26205519 | 2.08469851 | 2.01278530 | 2.03906229 | 2.14934737 |

**Table 35. Continued**

| | Economic Sector | 7<br>Swingle Bench/ Hazen/Fernley Alfalfa<br>$ | 8<br>Agricultural Services<br>$ | 9<br>Gold Mining<br>$ | 10<br>Other Mining<br>$ | 11<br>Construction Communications<br>$ | 12<br>Manufacturing<br>$ |
|---|---|---|---|---|---|---|---|
| 1 | Dairy Production | 0.00009766 | 0.00004010 | 0.00002592 | 0.00003131 | 0.00007149 | 0.00065020 |
| 2 | Livestock Production | 0.00121799 | 0.00773522 | 0.00048212 | 0.00063570 | 0.00113846 | 0.00895354 |
| 3 | Other Production Agriculture | 0.00034225 | 0.00047323 | 0.00002757 | 0.00003814 | 0.00007521 | 0.00014243 |
| 4 | Other Hay | 0.00001055 | 0.00000420 | 0.00000121 | 0.00000145 | 0.00000336 | 0.00002598 |
| 5 | Feed Grains | 0.00000442 | 0.00000139 | 0.00000075 | 0.00000100 | 0.00000706 | 0.00001108 |
| 6 | Rest of Alfalfa | 0.00096479 | 0.00008370 | 0.00001960 | 0.00002133 | 0.00008124 | 0.00008826 |
| 7 | Swingle Bench /Hazen/Fernley Alfalfa | 1.00000000 | 0.00000440 | 0.00000029 | 0.00000046 | 0.00001758 | 0.00000036 |
| 8 | Agricultural Services | 0.02640519 | 1.00000000 | 0.00067775 | 0.00072475 | 0.00200564 | 0.00149686 |
| 9 | Gold Mining | 0.00011970 | 0.00006807 | 1.00000000 | 0.00451951 | 0.00018007 | 0.00078297 |
| 10 | Other Mining | 0.00122384 | 0.00066516 | 0.02741768 | 1.00000000 | 0.00188040 | 0.00475497 |
| 11 | Construction | 0.04112278 | 0.01514085 | 0.01517004 | 0.02391080 | 1.00000000 | 0.01691750 |
| 12 | Manufacturing | 0.07457361 | 0.04902194 | 0.03728270 | 0.04496251 | 0.10361843 | 1.00000000 |
| 13 | Transportation & Communication | 0.06031755 | 0.03476454 | 0.02275992 | 0.03642165 | 0.04533172 | 0.04501806 |
| 14 | Utilities | 0.04468719 | 0.02162792 | 0.02178079 | 0.03946940 | 0.02016826 | 0.03186129 |
| 15 | Trade | 0.33455353 | 0.09311408 | 0.05204493 | 0.07673612 | 0.13441243 | 0.09801413 |
| 16 | Eating & Drinking | 0.00737225 | 0.01181467 | 0.00635899 | 0.01002717 | 0.00863613 | 0.00721012 |
| 17 | Finance Insurance and Real Estate | 0.15714254 | 0.08752766 | 0.05029113 | 0.10560851 | 0.07658214 | 0.06056811 |
| 18 | Hotel Gaming and Recreation | 0.03801889 | 0.03012330 | 0.01734204 | 0.02689843 | 0.02767101 | 0.02472157 |
| 19 | Services | 0.14474932 | 0.08901175 | 0.05318109 | 0.08217188 | 0.12629543 | 0.09597860 |
| 20 | Health | 0.03815378 | 0.06461879 | 0.03306223 | 0.05261225 | 0.04510499 | 0.03339481 |
| 21 | Households | 0.34805980 | 0.59955821 | 0.30644668 | 0.48787541 | 0.41667037 | 0.30660995 |
| | Column Total | 2.31913764 | 2.10539917 | 1.64437343 | 1.99266779 | 2.00995143 | 1.73720081 |

**Table 35. Continued**

| | Economic Sector | 13 Transportation and Communication $ | 14 Utilities and Lodging $ | 15 Trade and Real Estate $ | 16 Eating and Drinking $ | 17 Finance Insurance and Real Estate $ | 18 Hotel Gaming and Recreation $ |
|---|---|---|---|---|---|---|---|
| 1 | Dairy Production | 0.00003459 | 0.00002399 | 0.00002926 | 0.00005850 | 0.00002764 | 0.00003959 |
| 2 | Livestock Production | 0.00064997 | 0.00052662 | 0.00058810 | 0.00154612 | 0.00052299 | 0.00064873 |
| 3 | Other Production Agriculture | 0.00003400 | 0.00003406 | 0.00003864 | 0.00017860 | 0.00006843 | 0.00003347 |
| 4 | Other Hay | 0.00000154 | 0.00000112 | 0.00000140 | 0.00000282 | 0.00000203 | 0.00000164 |
| 5 | Feed Grains | 0.00000102 | 0.00000098 | 0.00000092 | 0.00000141 | 0.00000129 | 0.00000098 |
| 6 | Rest of Alfalfa | 0.00001866 | 0.00001702 | 0.00002503 | 0.00003123 | 0.00009583 | 0.00002976 |
| 7 | Swingle Bench /Hazen/Fernley Alfalfa | 0.00000051 | 0.00000084 | 0.00000035 | 0.00000041 | 0.00000090 | 0.00000139 |
| 8 | Agricultural Services | 0.00061134 | 0.00055507 | 0.00088292 | 0.00103635 | 0.00360425 | 0.00212965 |
| 9 | Gold Mining | 0.00007821 | 0.00131660 | 0.00007335 | 0.00012346 | 0.00005979 | 0.00008677 |
| 10 | Other Mining | 0.00078994 | 0.01721631 | 0.00076954 | 0.00121761 | 0.00063965 | 0.00101833 |
| 11 | Construction | 0.02728908 | 0.04627448 | 0.01776462 | 0.02110396 | 0.04863252 | 0.02128914 |
| 12 | Manufacturing | 0.05056320 | 0.03421780 | 0.04147153 | 0.08612479 | 0.03129148 | 0.05177044 |
| 13 | Transportation & Communication | 1.00000000 | 0.03415420 | 0.04188706 | 0.04002337 | 0.03127056 | 0.02943909 |
| 14 | Utilities | 0.02477458 | 1.00000000 | 0.02894700 | 0.04230818 | 0.02346275 | 0.03350352 |
| 15 | Trade | 0.07575650 | 0.06728078 | 1.00000000 | 0.10203963 | 0.05952054 | 0.06248284 |
| 16 | Eating & Drinking | 0.00968436 | 0.00924998 | 0.00967133 | 1.00000000 | 0.00863465 | 0.00811255 |
| 17 | Finance Insurance and Real Estate | 0.08431216 | 0.07334432 | 0.09764233 | 0.09834587 | 1.00000000 | 0.17025613 |
| 18 | Hotel Gaming and Recreation | 0.02751155 | 0.02382172 | 0.02805520 | 0.03224295 | 0.02355329 | 1.00000000 |
| 19 | Services | 0.14895572 | 0.08312702 | 0.14597582 | 0.13007681 | 0.10762817 | 0.12497997 |
| 20 | Health | 0.04459878 | 0.04978048 | 0.04782810 | 0.04352363 | 0.04426097 | 0.06606623 |
| 21 | Households | 0.41132046 | 0.46208262 | 0.44221431 | 0.40039978 | 0.41003190 | 0.33169513 |
| | Column Total | 1.90698618 | 1.90302601 | 1.90386682 | 2.00038548 | 1.79330961 | 1.90358535 |

**Table 35. Continued**

| | | 19 | 20 | 21 |
|---|---|---|---|---|
| | | Services | Health | Households |
| | Economic Sector | $ | $ | $ |
| 1 | Dairy Production | 0.00003610 | 0.00004048 | 0.00003873 |
| 2 | Livestock Production | 0.00069856 | 0.00080935 | 0.00096126 |
| 3 | Other Production Agriculture | 0.00004034 | 0.00005076 | 0.00006637 |
| 4 | Other Hay | 0.00000170 | 0.00000197 | 0.00000183 |
| 5 | Feed Grains | 0.00000115 | 0.00000120 | 0.00000140 |
| 6 | Rest of Alfalfa | 0.00002891 | 0.00003681 | 0.00002674 |
| 7 | Swingle Bench /Hazen/Fernley Alfalfa | 0.00000066 | 0.00000039 | 0.00000030 |
| 8 | Agricultural Services | 0.00099502 | 0.00130840 | 0.00092467 |
| 9 | Gold Mining | 0.00010004 | 0.00008621 | 0.00008643 |
| 10 | Other Mining | 0.00107204 | 0.00086330 | 0.00088266 |
| 11 | Construction | 0.03524705 | 0.01972525 | 0.01376398 |
| 12 | Manufacturing | 0.05172878 | 0.05737647 | 0.05445315 |
| 13 | Transportation & Communication | 0.04506042 | 0.04528014 | 0.04345662 |
| 14 | Utilities | 0.02757050 | 0.02948773 | 0.03246264 |
| 15 | Trade | 0.07493910 | 0.08557795 | 0.12754506 |
| 16 | Eating & Drinking | 0.00965081 | 0.01216003 | 0.01919019 |
| 17 | Finance Insurance and Real Estate | 0.10132830 | 0.12230093 | 0.13727893 |
| 18 | Hotel Gaming and Recreation | 0.02834955 | 0.03344848 | 0.04586543 |
| 19 | Services | 1.00000000 | 0.16233907 | 0.11945548 |
| 20 | Health | 0.04702416 | 1.00000000 | 0.10753338 |
| 21 | Households | 0.43433072 | 0.51313173 | 1.00000000 |
| | Column Total | 1.85820390 | 2.08402663 | 1.70399522 |

# APPENDIX D:

## Definitions of Selected Economic Terms, Functions and Model Sectors

## Definitions of Selected Economic Terms and Functions

**Community Economics** - Field of economics that investigates the interrelationships or linkages that exist among economic sectors within a local economy.

**Input-Output Model** - A mathematical representation of the purchases and sales patterns of a given economy. Measures the relationships between basic industries, households, and service firms.

**Basic Industries** - Those industries that produce goods and services primarily for sale outside the economy.

**Households** - Consumers, also serve as support for basic industries and supply labor.

**Service Firms** - Provide goods and services to households and inputs to basic industries.

**Final Demand** - Purchases of goods and services for final consumption.

**Output** - Sales or value of production (agriculture) from an industry.

**Social Accounting Matrix (SAM)** - A detailed itemization of the sources and destinations of income flows throughout an economy.

**Employment (Employment Impacts)** - The number of jobs in an economy. This number consists of full and part-time jobs not FTE's. The impacts are reported as jobs lost or gained in a given industry.

**Direct Impacts** - Activities or changes in production level of the impacted industry. Entered on the model menu as FD Changes.

**Indirect Impacts** - Occur in the local business sector as a result of providing inputs to the impacted industry.

**Induced Impacts** - The economic activity caused by household consumption in a local economy from the direct and indirect effects.

**Value Added** - Factors used in an economy in the production process. These include employee compensation, proprietary income, other property income and indirect business taxes.

Definition of Model Sectors

**Dairy Production** - Agricultural production of milk for processing such as cheese, milk and other dairy products.

**Livestock Production** - Agricultural production of range cattle, sheep, horses etc.

**Other Production Agriculture** - All agricultural production not included in any other model sector. This sector includes orchards, vegetables, melons etc.

**Other Hay** - Agricultural production of pasture and hays other than alfalfa.

**Feed Grains** - Agricultural production of feed grains including corn, barley etc.

**Rest of Alfalfa** - Alfalfa hay grown in all areas of the TROA/WQSA study area excluding the Swingle Bench area, Hazen and Fernley in Lyon County.

**Swingle Bench/Hazen/Fernley Alfalfa** - Alfalfa hay grown strictly in the Swingle Bench, Hazen, and Fernley areas.

**Agricultural Services** - Agricultural service fields including custom hire, veterinarian, lawn services, etc.

**Gold Mining** - Industries engaged in the extraction of gold ores.

**Other Mining** - All industries engaged in mining for minerals, oil and gas extraction, and geothermal activities except for gold mining.

**Construction** - All building and construction of dwellings by general contractors, heavy construction of highways and specialty contractors.

**Manufacturing** - Industries engaged in the chemical or mechanical transformation of raw materials into new products.

**Transportation & Communication** - Transportation and communication related industries, including local government passenger transportation and communication systems.